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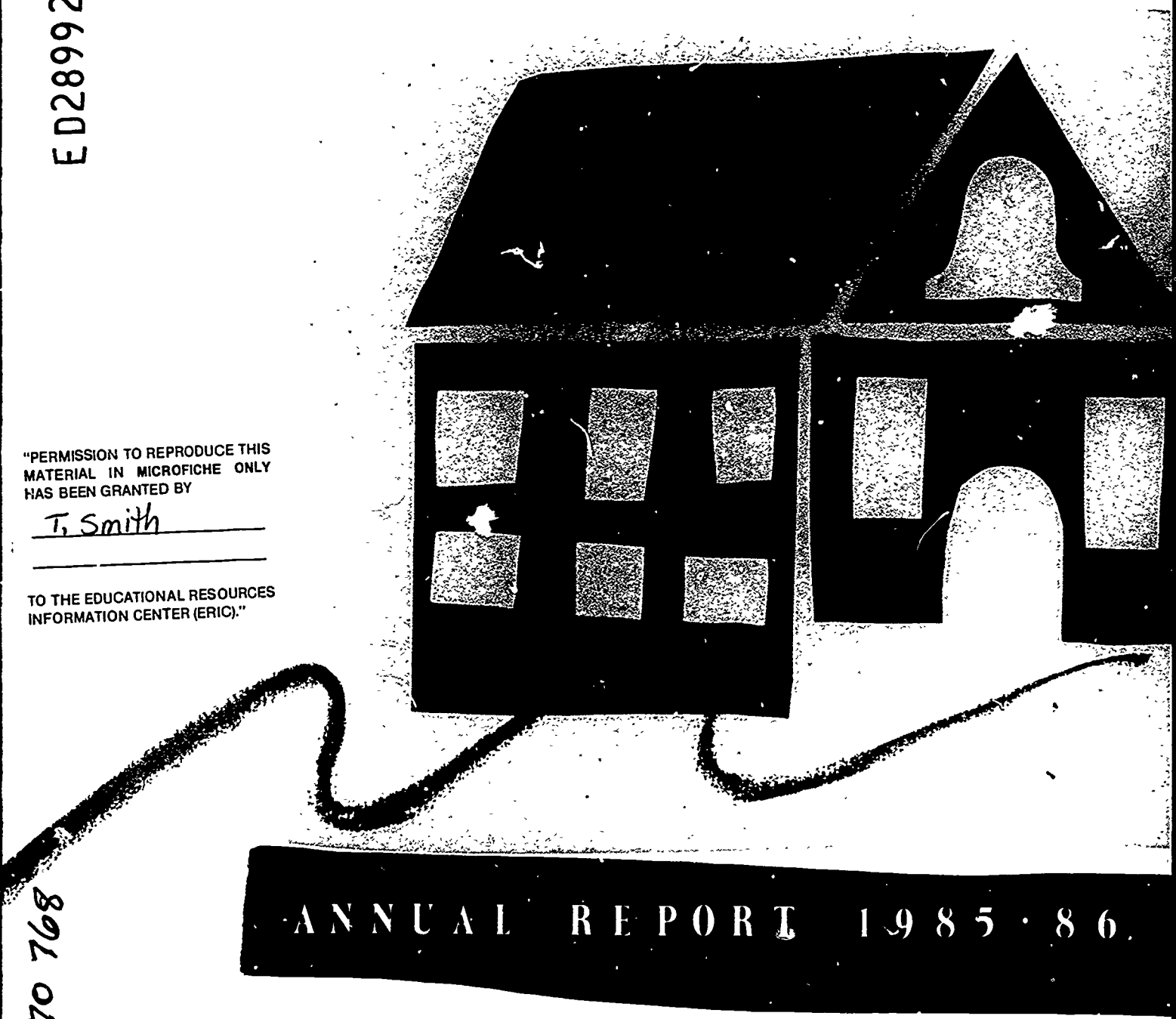
ABSTRACT

The California Assessment Program (CAP) collects a wide range of achievement and demographic data to help local schools and districts improve their instructional programs. Tests in the areas of English/language arts, mathematics, history-social science and science designed by California educators are administered to students in grades 3, 6, 8, and 12 annually. The introductory chapter to this annual report gives background data and information regarding the CAP. Scholastic Aptitude Test results are also summarized. Chapter 2 contains demographic data revealing California's diversity in student population, including ethnic group, language fluency, and socioeconomic status. The number of various types of courses taken by twelfth graders is included along with the amount of time students spend watching television, reading for pleasure, doing homework, and working on writing assignments. The body of this report, as seen in chapters 3 through 6, contains information about the 1985-86 results for reading, written expression, mathematics, history-social science, and science. Statewide results showed improvement for all test scores for all grade levels and all content areas except two. The two declines occurred in grade eight history-social science and grade twelve reading. The observations and recommendations of teachers and local curriculum specialists appear in the content area chapters. (KSA)

CALIFORNIA ASSESSMENT PROGRAM



ANNUAL REPORT 1985·86

CALIFORNIA STATE DEPARTMENT OF EDUCATION
BILL HONIG·SUPERINTENDENT OF PUBLIC INSTRUCTION
SACRAMENTO·1986

California Assessment Program

Annual Report

Prepared under the direction of
Francie Alexander, Director
Curriculum, Instruction, and Assessment Division

California State Department of Education

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Acknowledgments

Many persons from California and other parts of the U.S. contributed to the California Assessment Program and, therefore, directly or indirectly to this report. Prominent among those contributors are the assessment advisory committees. Some of the most respected educators in their specialties, the committee members work throughout the year in test development, data analysis, and assessment policy formation. The names of the assessment advisory committee members are listed in the appendixes for the content areas.

Under the guidance of the advisory committees and the coordination of Ed Hensley, members of the California Assessment Program staff supervised the preparation of the chapters of this report:

English/language arts—**Diane Levin** and **Beth Breneman**,with the report-writing committee of Helen Lodge, Alice Scofield, and Alpha Quincy
Mathematics—**Tej Pandey** and **Bonnie Williamson**
History-social science—**Peter Kneedler** and **Juanita Jorgenson**
Science—**Linda Zimmerer** and **Zack Taylor**

All the staff and contract personnel of the California Assessment Program participated in the activities that this report represents: Sue Bennett, Sunni Chacon, Michelle Hey, Maria Hernandez, Gary Konas, Ying Sang Man, Sandy McDevitt, and Pat McCabe.

The value of the production specialists cannot be measured; they wove threads of many textures into whole cloth: **John Robert Cornell, Mary Dean,** and **Mark Hoffeditz.**

INTRODUCTION

The California Assessment Program (CAP) annually administers achievement tests to all students at grades three, six, eight, and twelve. Statewide achievement testing began in 1962. Through 1972 a variety of grades were tested with one or more standardized achievement tests. The tests, which measured reading, written language, and mathematics, took about four hours to administer and were expected to serve local purposes as well as provide statewide results.

CAP tests all students in grades three, six, eight, and twelve every year.

But standardized tests had two chief problems. They did not match California's curriculum, and they took too long to administer. As a result, the California Assembly Education Advisory Committee recommended separating local and statewide testing. Local testing could, then, use a variety of tests to meet the needs of schools' and districts' requirements for assessing individual students, and state testing could focus on the program level.

Because the main purpose of statewide testing was deemed to be evaluation of instructional programs, CAP did not have to collect student-level data. Therefore, the new technique of matrix sampling (in which each student takes only a small part of a large test and results are averaged for groups) was the perfect tool. Using matrix sampling allowed CAP to develop large tests—over 1,000 items per grade level—and, therefore, produce more reliable information, covering a broader array of curricular elements. And because the tests are divided into many, nonoverlapping forms (varying from 18 to 40 at different grade levels), students spend little time taking the test. In grade three, for instance, each of the 30 students in a typical classroom takes a different form of the test. Each test form contains over 30 questions in the areas of reading, written language, and mathematics.

Matrix sampling allows CAP to administer a large test in a short time.

In the past, the chief vehicle for reporting CAP results to schools and districts has been the percent correct score (the total number of questions answered correctly divided by the total number of questions attempted). This type of score is still in use at grade twelve. The percent correct scores are useful (as long as the test remains unchanged) in comparing scores across years, but unfortunately such scores do not lend themselves very well to other kinds of comparisons.

A scaled score system is now being used for reporting results at grades three, six, and eight. It was developed in conjunction with the third grade *Survey of Basic Skills*, first administered in 1980. Scaled

scores have several advantages over percent correct scores: they permit score comparisons from year to year, among content areas, and across grade levels. First-year state-level scores are always assigned the scaled score of 250. Actual scaled scores range from approximately 100 to 400.

Most notably among recent education reform initiatives are SB 813 (the Hughes-Hart Educational Reform Act) and Superintendent of Public Instruction Honig's reform agenda from within the Department of Education. Both call for the testing of higher-level skills, not just basic skills.

CAP has moved away from testing basic skills to testing "academic" skills. The newest CAP tests reflect this emphasis on higher-level skills. The Golden State examinations, scheduled to begin implementation in 1987, will be end-of-course tests used for determining honors status and for affording other academic recognition. The *Survey of Academic Skills: Grade 8* was administered for the first time in 1983-84. The first administration included the same areas covered by the other tests—reading, written expression, and mathematics. In 1984-85 the content area of history-social science was added to the grade eight test. This year science was added, making the grade eight test the first one to cover the full range of content areas proposed for CAP testing.

Direct Writing Assessment

Starting in the spring of 1987, the grade eight test will be expanded in another dimension. The depth of its coverage of writing skills within the language arts will be increased by the addition of a direct assessment of students' writing.

CAP plans to administer essay tests to almost 300,000 eighth graders in 1987.

Direct writing assessment is a very old concept in the classroom. Teachers in all disciplines give essay assignments and essay tests not just as the best way to learn how students write, but as the best way to learn what and how students think. The teachers give students a topic and ask them to write a certain kind of essay. Then the teacher grades the essay on the basis of the subject matter, writing processes, and grammatical conventions that have been covered in class or that students are expected to have mastered.

Classroom teachers who shudder to think of grading the essays for a class or two will appreciate CAP's endeavor. CAP plans to administer essay tests to almost 300,000 eighth grade students in the spring of 1987 in conjunction with the administration of the *Survey of Academic Skills: Grade 8*.

The addition of direct writing assessment is certainly CAP's most complex undertaking logistically. But it is more than that. It is a sign of the Department of Education's commitment to working with all educators to drive the academic reform movement rather that just riding along on its momentum. The testing of higher-level skills, the expansion into history-social science and science, the Golden State Examination Program, and now the direct assessment of writing are assertions of educational standards and goals that will guide educators, parents, public officials, and the general public in California and across the nation. In the past few years, several reports have reminded us that

education can help children achieve their highest goals, but first education must set worthy goals for itself. Shaping and supporting curricular and pedagogical goals is the primary function of a comprehensive assessment program.

Contents of the Annual Report

Helping to improve local instructional programs is CAP's main purpose. CAP collects a wide range of achievement data and demographic data to help a school or a district evaluate its programs and to guide it in modifying them. The tests are designed and developed by California educators serving on the content area assessment advisory committees (see the appendixes for lists of committee members) as well as teachers and content area specialists from throughout the state.

The purpose of CAP is to aid in evaluating educational programs.

The results of CAP tests, by design, are not reported for individual students. The scores are aggregated to provide comprehensive and stable average scores for a group, essentially schools and districts. Because the tests are large, reliable scores can be provided for a wide variety of student groups and for subskills within each content area. Several years' worth of subskill data for each grade level tested in the various content areas can be found in the appendixes:

- Appendix C—English/language arts
- Appendix D—Mathematics
- Appendix E—History-social science
- Appendix F—Science

This chapter and Chapter 2 contain background information that will provide a setting for the content area results that follow in chapters 3 through 6. This chapter contains state and national data that provide a context for understanding both local results and the state-level content area results contained in this report.

Student Demographics

Chapter 2 contains a summary of the demographic data collected by CAP. The data reveal the range of California's diversity. The major categories described within this huge student population include ethnic group, language fluency, and socioeconomic status. The number of various types of courses taken by twelfth graders is also included, along with the amount of time spent watching television, reading for pleasure, doing homework, and number of writing assignments.

Background information on students helps in planning and providing better educational programs.

Content Area Results

The body of this report contains presentations of the 1985-86 results for the content areas of reading, written expression, mathematics, history-social science, and science. The advisory committees that devel-

op CAP tests also participate in the analysis of the results. There is no substitute for the experience of teachers and local curriculum specialists in interpreting the state-level test results. The observations and recommendations of the statewide committees appear in the content area chapters.

English/language arts. Reading and written expression are discussed together in Chapter 3. The Department and its language arts assessment advisory committees believe that reading and writing cannot be taught in isolation. The results of the two tests are, therefore, discussed in terms of their overlapping skill areas and instructional necessities.

For several years now, CAP has been moving toward a fuller integration of reading and writing. The revised grade six test and the grade eight test reflect that integration—within the bounds of the multiple choice format. In the grade eight test, for example, students answer reading questions based on a reading passage and then written expression questions based on an essay. The essays used in the tests were written by students in response to writing prompts (topics) drawn from the reading passages. The direct assessment of writing, which is scheduled to begin at grade eight in the spring of 1987, will even further extend CAP's ability to provide schools and districts with accurate and useful information about their English programs.

Mathematics. The statewide mathematics scores for all grade levels increased this year. The mathematics results for grades three, six, eight, and twelve are summarized and discussed in Chapter 4. The mathematics results are scrutinized in light of the need for skill development within strands of the mathematics curriculum across grade levels, especially as emphasized in the *Mathematics Framework for California Public Schools* (1985).

History-social science. This is the second year that CAP has administered a history-social science test at grade eight. At the state level, the history-social science score fell by seven scaled score points from last year's. Specific skill areas within history-social science are discussed and illustrated in Chapter 5.

Science. CAP included science for the first time in the 1985-86 grade eight test. The results of that first administration are discussed in Chapter 6. The state-level strengths and weaknesses held a few surprises, but the full range of the results will be invaluable to science educators as a context for evaluating their local results and programs. Of special interest will be the results of 30 science research questions. Students were asked about their attitudes toward science, the amount of training they had received in science, and the extent of their exposure to science-related activities.

The 1985-86 Statewide Results

All scores for all grade levels and all content areas except two increased in 1985-86. The two declines occurred in grade eight history-social science (down seven scaled score points) and grade twelve reading (down 0.2 percent correct). Table 1 contains all statewide results since 1979-80.

Grade level and content area	Average test score, by year							Difference in scores, by year					
	79-80	80-81	81-82	82-83	83-84	84-85	85-86	79-80 to 80-81	80-81 to 81-82	81-82 to 82-83	82-83 to 83-84	83-84 to 84-85	84-85 to 85-86
Grade 3													
N=310,008													
Reading	250	254	258	263	268	274	280	+4	+4	+5	+5	+6	+6
Written Language	250	255	260	266	272	279	285	+5	+5	+6	+6	+7	+6
Mathematics	250	254	261	267	274	278	283	+4	+7	+6	+7	+4	+5
Grade 6													
N=287,478													
Reading	250	252	254	253	249	253	260	+2	+2	-1	-4	+4	+7
Written Language	250	253	257	259	260	265	271	+3	+4	+2	+1	+5	+6
Mathematics	250	253	258	260	261	264	268	+3	+5	+2	+1	+3	+4
Grade 8													
N = 285,743													
Reading	---	---	---	---	250	240	243	---	---	---	---	-10	+3
Written Expression	---	---	---	---	250	246	248	---	---	---	---	-4	+2
Mathematics	---	---	---	---	250	251	253	---	---	---	---	+1	+2
History-Social Science	---	---	---	---	---	250	243	---	---	---	---	---	-7
Science	---	---	---	---	---	---	250	---	---	---	---	---	---
Grade 12													
N = 212,894													
Reading	63.1	63.4	63.2	63.1	62.2	62.9	62.7	+0.3	-0.2	-0.1	-0.9	+0.7	- 0.2
Written Expression	62.4	63.1	63.2	63.0	62.6	63.2	63.4	+0.7	+0.1	-0.2	-0.4	+0.6	+0.2
Spelling	68.8	69.0	69.5	69.5	69.4	69.7	70.1	+0.2	+0.5	0.0	-0.1	+0.3	+0.4
Mathematics	66.8	68.0	67.7	67.7	67.4	68.3	68.7	+1.2	-0.3	0.0	-0.3	+0.9	+0.4

Table 1

Average CAP Test Scores by Grade Level and Content Area, and Difference in Scores, by Year, 1979-80 Through 1985-86

Grade three. Scores in all areas of grade three continued long-term gains. The gains in all three areas were strong. Reading and written language each gained six scaled score points; mathematics gained five points (see Figure 1.1).

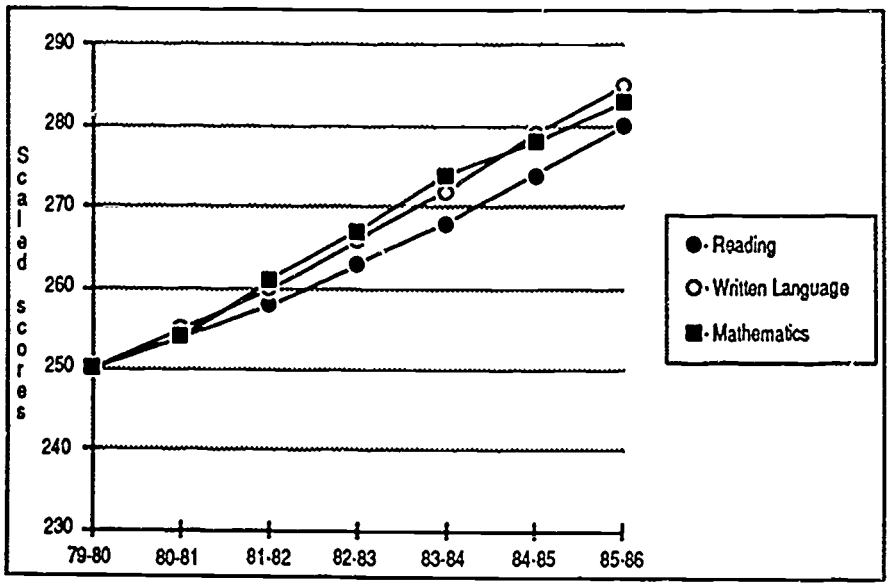


Figure 1.1

Grade Three CAP Scores, 1979-80 Through 1985-86

Grade six. The scores for grade six (see Figure 1.2) have not shown nearly the consistency that third grade scores have. Compare the ups and downs of sixth grade reading scores (Figure 1.3) with the steady increases in grade three reading (Figure 1.4).

Figure 1.2

Grade Six CAP Scores, 1979-80 Through 1985-86

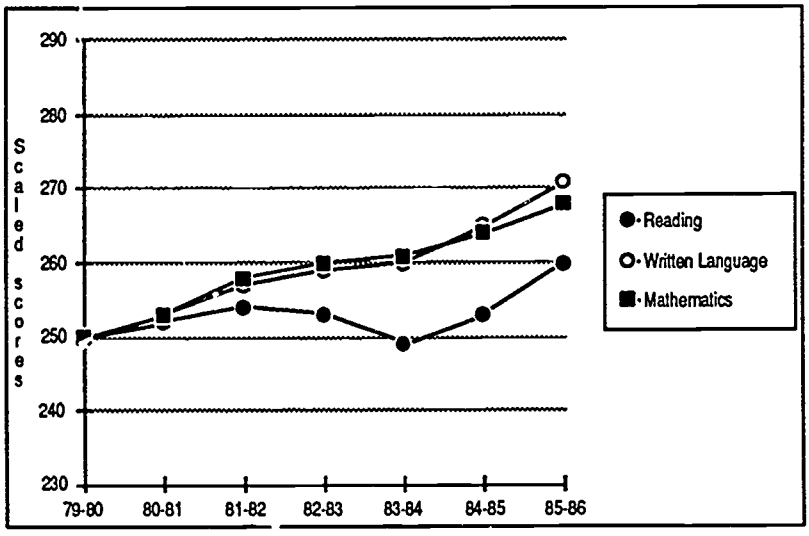


Figure 1.3

Changes in Grade Six Scores, 1980-81 Through 1985-86

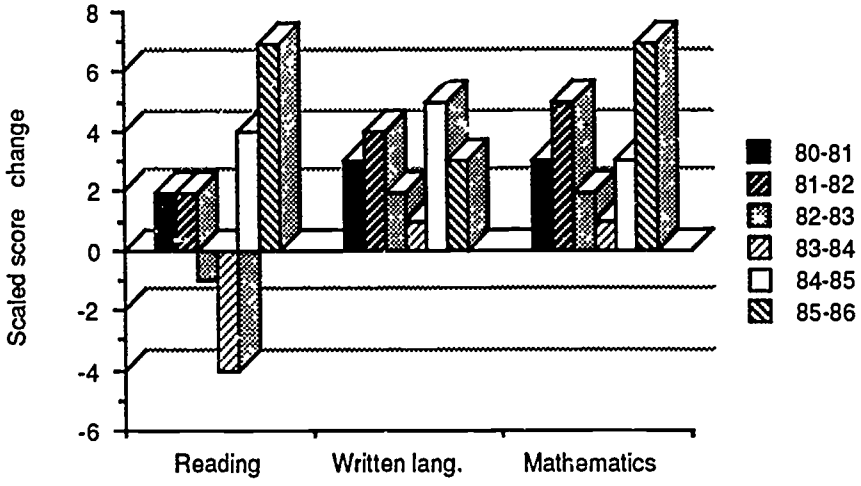
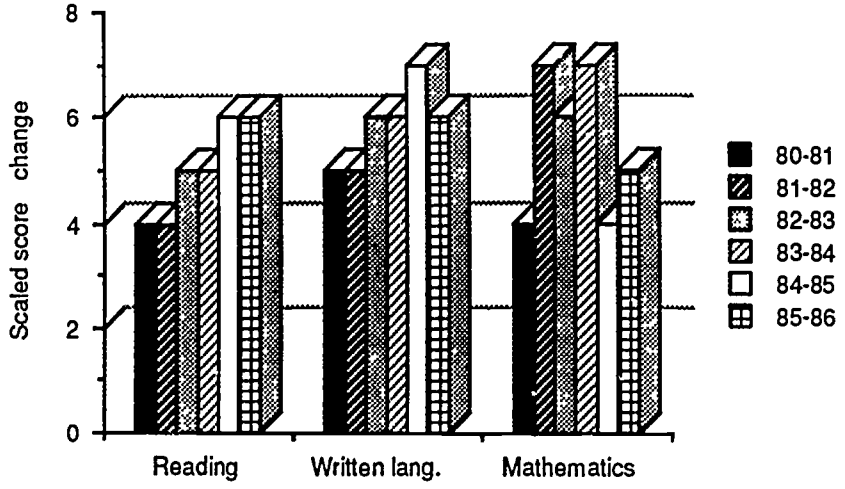


Figure 1.4

Changes in Grade Three Scores, 1980-81 Through 1985-86



Grade eight. The eighth grade *Survey of Academic Skills* has been administered by CAP only since 1983-84; therefore, long-term trends have yet to show themselves. However, eighth graders reversed the substantial drops that occurred in reading and written expression scores last year (see Figure 1.5). Scores in all three basic content areas were up, but only the mathematics score is now above the initial statewide average score of 250. History-social science showed a decrease similar in size to that experienced in grade eight reading last year. Figure 1.6 shows the total changes in scores on the grade eight test since its first administration.

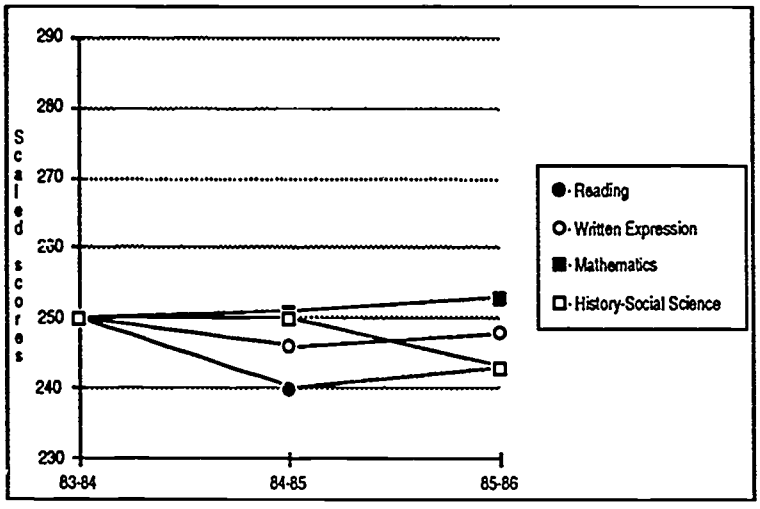


Figure 1.5

Grade Eight CAP Scores, 1983-84 Through 1985-86

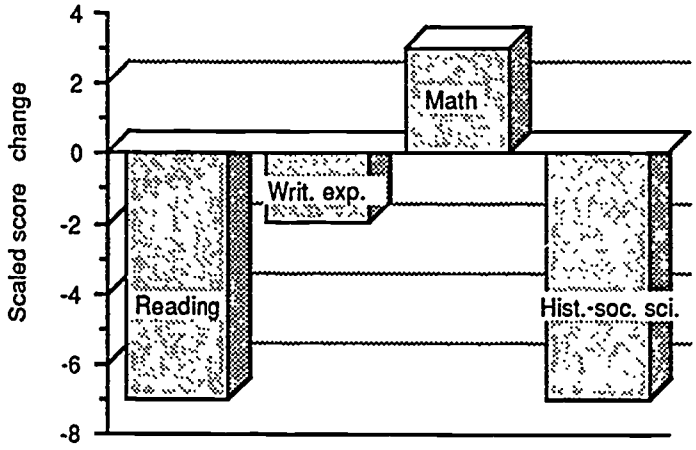


Figure 1.6

Total Changes in Grade Eight Scores from First Administration

Grade twelve. The reading score was the only one to drop at grade twelve in 1985-86 (see Figure 1.7). Written expression and mathematics scores have both increased since 1983-84. The written expression score is now 1.1 percent correct higher than it was in the first year of the test's administration, 1975-76. The mathematics score is 1.7 percent correct higher than it was in 1975-76. In contrast, the reading score in the same time period dropped a total of 1.5 percent correct. Figure 1.8 shows these total changes for grade twelve scores.

Figure 1.7

Grade Twelve CAP Scores, 1979-80 Through 1985-86

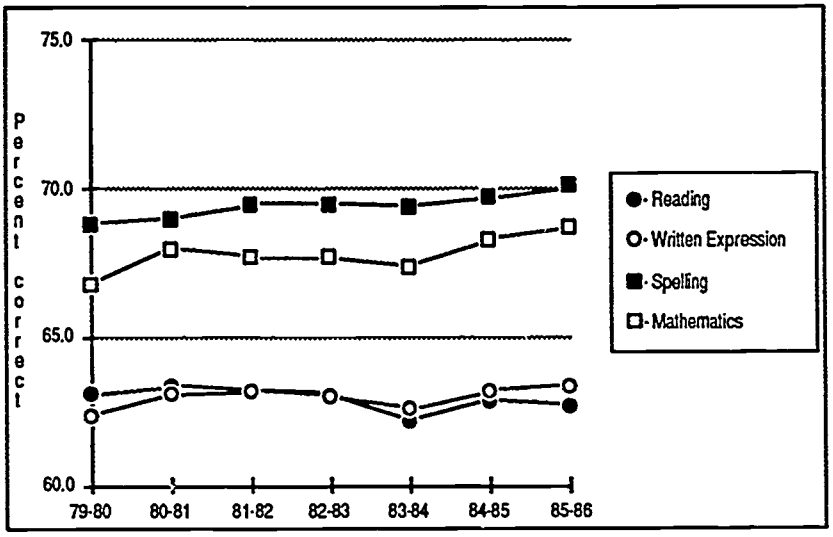
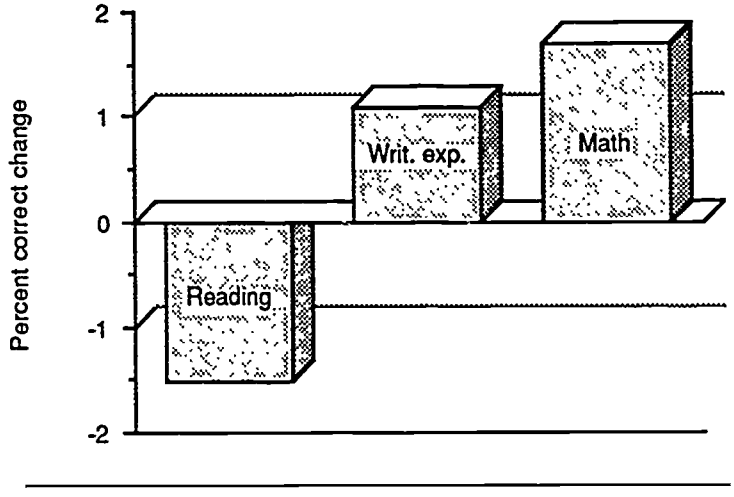


Figure 1.8

Total Changes in Grade Twelve Scores from First Administration



National Norms

Each year the CAP tests are equated with tests that have national norms. This equating is designed to show how California's students would have compared to students nationwide if the California students had taken the national tests. The national norm data for previous years is contained in Appendix A. For 1985-86 the norming studies showed the following:

Third grade students score well against all the national norms used (*CTBS*, 1973 and 1981; and *Stanford*, 1982). On the three norms, California's scores placed, respectively, as follows:

- Reading—71st, 55th, and 51st percentiles
- Written language—66th, 51st, and 54th percentiles
- Mathematics—67th, 63rd, and 62nd percentiles

Sixth grade students remain above the national average in all areas on all norms used (*CTBS*, 1973 and 1981; and *Stanford*, 1982):

- Reading—59th, 54th, and 52nd percentiles
- Written language—62nd, 54th, and 62nd percentiles
- Mathematics—64th, 66th, and 59th percentiles

Eighth grade students are very close to the national average in written expression and mathematics but substantially below in reading (*CTBS*, 1981 norms):

- Reading—36th percentile
- Written expression—49th percentile
- Mathematics—49th percentile

Twelfth grade students remain close to the national average in mathematics but generally well below in reading and written expression (*ITED*,1962 and 1978; *TAP*, 1970 and 1978; *STEP*, 1970 and 1978). The California scores on the six norms fall into the following ranges:

- Reading—31st to 47th percentile
- Written expression—29th to 57th percentile
- Mathematics—43rd to 61st percentile

It must be noted that these are estimated norms. The variation is a sign of the fact that no "real" national norms exist. Only a carefully designed test taken by every student in the country at a certain grade level would produce such a true measure. Three factors are most important in causing the variations: (1) the huge variation in the samples drawn upon by different publishers; (2) changes in the student population and in educational programs nationwide; and (3) similar changes in California. Because of the variations, CAP calculates several estimated norms for most grade levels. The range of norm values is a better view of California's national standing than any one norm.

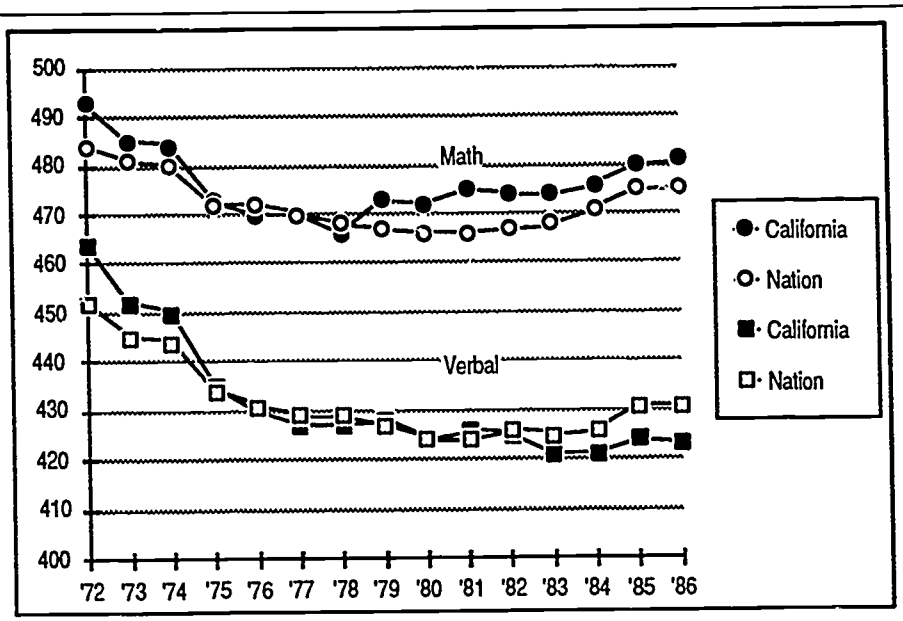
Scholastic Aptitude Test

The *Scholastic Aptitude Test* (*SAT*), administered by the College Board is a national college admissions test. It is designed for a purpose different from that of the CAP tests, and it is taken by a select sample of students in California and the nation. Just over 100,000 students took the SAT in California in 1985-86 (in contrast, CAP tested over 212,000 twelfth graders). However, SAT scores have a general pattern similar to that of CAP scores. The results of the SAT for California and the U.S. since 1971-72 are in Appendix A.

California is following the national pattern of relative stability. National mathematics and verbal scores for 1985-86 did not change (see Figure 1.9). California's mathematics score increased by one point; the verbal score decreased by one point. California is 6 points above the na-

Figure 1.9

SAT Math and Verbal Scores for California and the Nation, 1971-72 Through 1985-86

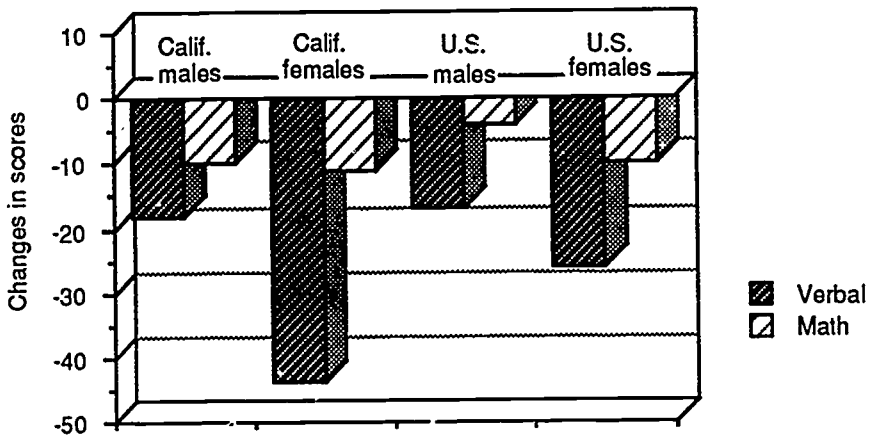


tional average in mathematics but 8 points below the national average verbal score.

Since 1971-72, the first year that the College Board distributed state data, all scores have lower in California and the United States (see Figure 1.10). Verbal scores have dropped much more than mathematics

Fig. 1.10

Changes in *SAT* Scores for Males and Females in California and the U.S., 1971-72 Through 1985-86



scores, and females' scores more than males' scores. For instance, California females' verbal score has dropped four times as much as their mathematics score.

As was the case in the nation as a whole, females outnumbered males in taking the SAT:

- United States—481,477 males; 519,271 females
- California—51,699 males; 56,588 females

The males continue to hold an advantage in the scores, however, in California and the nation. The verbal score for males is 10 points higher than that of females in California, 11 points higher in the U.S. In mathematics males scores are 52 points higher in California and 50 points higher in the U.S. In both categories, females' scores are below the overall average, and males' scores are above.

Chapter 2
STUDENT DEMOGRAPHICS

In addition to reporting test results, the California Assessment Program collects background information on all students tested at grades three, six, eight, and twelve. The information on student characteristics is coded into the test booklets and questionnaires by students or their teachers. The purpose of collecting this type of information is threefold: (1) it enables educators to examine the characteristics of the student population in California; (2) it allows CAP to provide test results for different subgroups of students; and (3) it provides the information needed to calculate the comparison score bands and school performance groups (socioeconomic status, percent of limited-English proficient students, percent of students receiving aid to families with dependent children (AFDC), and student mobility).

The means of collecting the data vary somewhat by grade level. Teachers must provide more of the information at the lower grade levels. At the higher grade levels, more information comes directly from the students.

Grade three teachers provide information on:

- Sex
- Mobility (school level)
- Grades repeated
- English language fluency
- Other languages spoken
- Socioeconomic status (based on parent occupation)
- Participation in specially funded programs

Grade six students provide information on:

- Sex
- Mobility (school and district level)
- Time spent reading and watching television
- Time on homework
- Number of writing assignments
- Attitudes toward various school subjects

Grade six teachers provide information on:

- Participation in specially funded programs
- Socioeconomic status (based on parent occupation)
- English language fluency
- Other languages spoken

Grade eight students provide information on:

- Sex
- Mobility (school and district level)
- Socioeconomic status (based on parent education)
- Time spent reading and watching television
- Number of writing assignments
- Time on homework
- Ethnic background

Grade eight teachers provide information on:

- Participation in specially funded programs
- English language fluency
- Other languages spoken

Grade twelve students provide information on:

- Sex
- Time on homework
- Number of writing assignments
- Courses completed
- Extracurricular activities
- Other languages spoken
- Mobility (school, district, state, and country)
- Time spent reading and watching television
- Socioeconomic status (based on parent education)
- Ethnic background

Grade twelve teachers provide information on:

- English language fluency

This chapter focuses on eight statewide demographic factors: socioeconomic status, English language fluency, ethnic background, courses completed, time spent watching television, time spent on homework, time spent reading for pleasure, and number of writing assignments completed. These eight features of the student population are discussed here for two reasons. First, they give a clear cross section view of California's students. Second, they have all typically shown a substantial correlation to achievement scores. Other background factors are discussed in relationship to test results for specific content areas in other chapters of this report. All the student demographic information is presented by grade level in the CAP school reports in the section titled "Student Subgroup Results." Tables of the 1985-86 demographic data discussed in this chapter are in Appendix B.

Socioeconomic Status

At grades three and six, parents' occupation is used as the indicator of socioeconomic status (SES). Teachers provide this information for each student. Occupation is used at the lower grade levels because a survey showed that teachers are more likely to know the occupation of a student's parents or guardians than other indicators of socioeconomic status. The teacher is given the following directions in the *Examiner's Manual*: "Mark the category that corresponds most closely to the occupation of the family's primary breadwinner. If the primary breadwinner is temporarily unemployed, retired, or a student, try to select the category that best represents his or her lifetime occupational level." The manual contains examples showing occupations that belong in each category.

Figure 2.1 shows the percent of third and sixth grade students in each of the parent occupation categories:

- Executives, professionals, and managers
- Semiprofessionals, clerical and sales workers, and technicians
- Skilled and semiskilled
- Unskilled employees (and welfare)
- Unknown

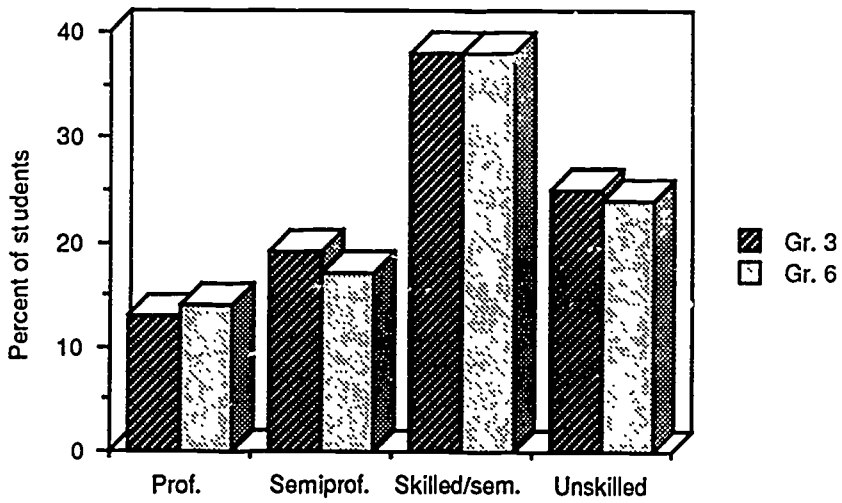


Figure 2.1

Percent of Third and Sixth Grade Students in Parent Occupation (Socioeconomic Status) Categories

At grades eight and twelve, students provide SES information based on the educational level of their parents. The instructions from the *Examiner's Manual* read to students by the teacher are as follows: "Of your parents, what is the highest educational level reached? Mark only one answer, the one for the educational level of your most educated parent." Students grid their responses directly onto their test booklets.

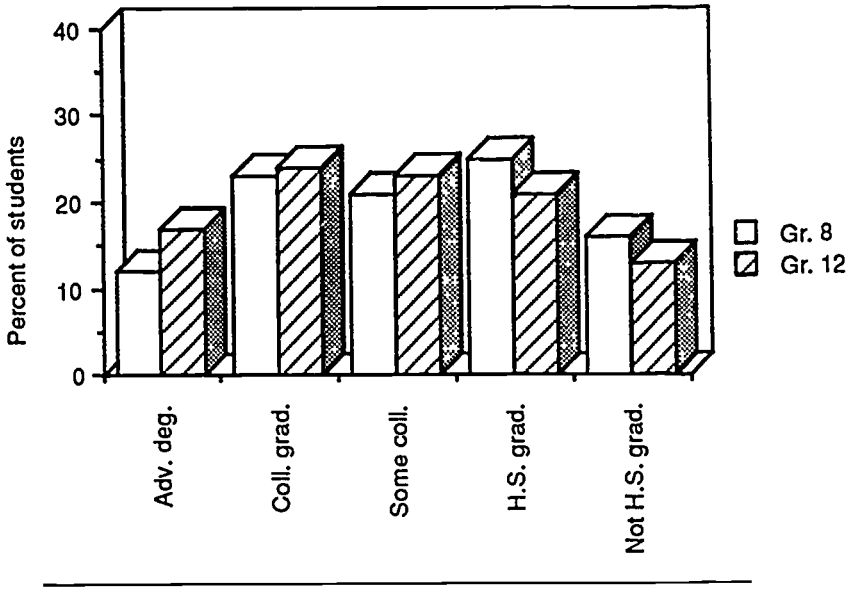
Figure 2.2 shows the percent of eighth and twelfth grade students in each of the parent education groups:

- Advanced degree
- Four-year college graduate
- Some college

- High school graduate
- Not a high school graduate

Figure 2.2

Percent of Eighth and Twelfth Grade Students in Parent Education (Socioeconomic Status) Categories



English Language Fluency

The California Assessment Program has historically used a language classification scheme that includes four categories:

- *English only.* At grades three, six, eight, and twelve, this classification includes students whose native language is English, even if they speak a second language.

- *Fluent-English speaking (FES).* At grades three, six, eight, and twelve, this classification consists of students whose primary language is other than English but who have clearly developed English language skills of comprehension, speaking, reading, and writing necessary to receive instruction in English only.

- *Limited English.* At grades three, six, and eight, students are classified as limited-English speaking (LES) if they have been determined, by the school, to be limited-English proficient (LEP) AND have received instruction in an English reading program (using district-adopted materials for English-speaking students) since November 1 of the current school year. All LES students *are* tested.

At grade twelve, students are classified as LEP (limited-English proficient) for purposes of the CAP test if they do not have the clearly developed language skills of comprehension, speaking, reading, and writing necessary to receive instruction only in English at a level substantially equivalent to students of the same age or grade whose primary language is English. All grade twelve LEP students *are* tested.

• *Non-English speaking (NES).* Students in this category are *not* tested. At grades three, six, and eight, students are NES if they have been classified as limited-English proficient (LEP) but have *not* received instruction in an English reading program since November 1 of the current school year. At grade twelve, there are no testing exemptions for students having a limited-English proficient status, so there is no NES classification at grade twelve.

Figure 2.3 shows the percent of third, sixth, eighth, and twelfth grade students in each of the language fluency groups. (NOTE: The limited-English and non-English speaking categories have been combined on this graph for grades three, six, and eight. This combined category is called limited-non-English.)

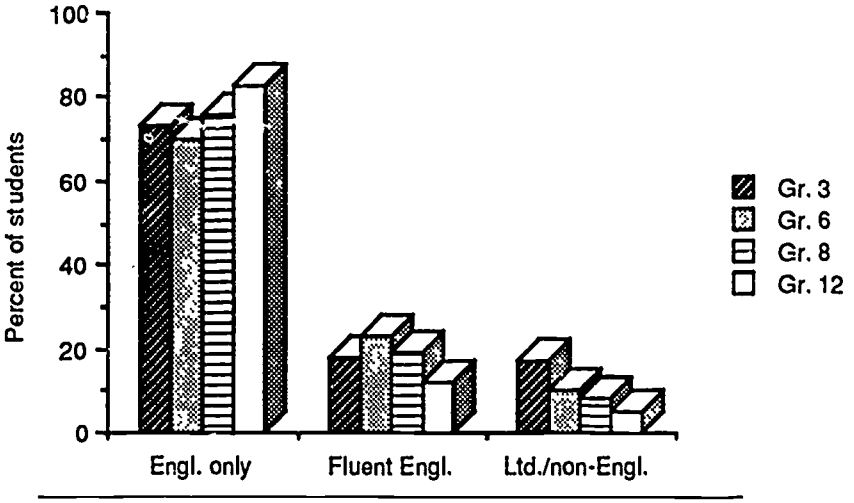


Figure 2.3

Percent of Third, Sixth, Eighth, and Twelfth Grade Students, by English Language Fluency Group

Ethnic Background

Information on the ethnic background of students is collected at grades eight and twelve. Figures 2.4 and 2.5 show the percent of students, at grade eight and grade twelve, respectively, in each ethnic background group.

- American Indian or Alaskan native
- Asian
- Pacific Islander
- Filipino
- Hispanic
- Black - not of Hispanic origin
- White - not of Hispanic origin

Students at both grade levels are asked to grid information regarding their ethnic background directly onto their test booklets and are given the following oral directions from the test administrator: "Fill in the circle that indicates your ethnic background or origin. If you are from more than one ethnic background, select the ethnic group with which you most closely identify."

Figure 2.4

Percent of Eighth Grade Students, by Ethnic Background Group

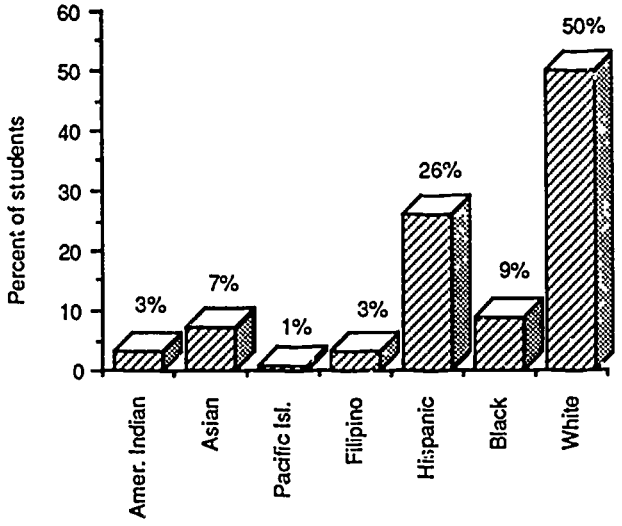
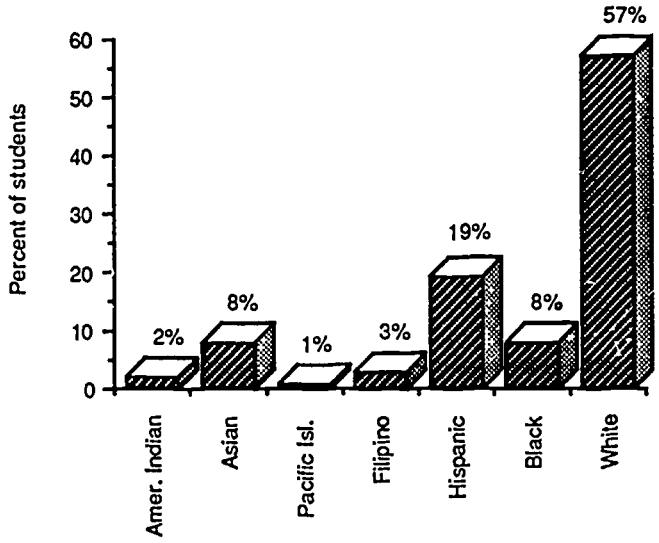


Figure 2.5

Percent of Twelfth Grade Students, by Ethnic Background Group



Courses Completed

Twelfth grade students are asked to provide information on the number of years of instruction they will have completed in various courses by the time they graduate from high school. The following question is from the grade twelve student supplement:

COURSES COMPLETED

By the time you graduate, how many years will you have completed in each of the following subject areas (grades 9 through 12)?

	NUMBER OF YEARS									
	0	½	1	1½	2	2½	3	3½	4	4½	5+
English	○	○	○	○	○	○	○	○	○	○	○
Mathematics	○	○	○	○	○	○	○	○	○	○	○
Science	○	○	○	○	○	○	○	○	○	○	○
History-Social Science	○	○	○	○	○	○	○	○	○	○	○
Foreign Language	○	○	○	○	○	○	○	○	○	○	○
Art, Music, Drama, Dance	○	○	○	○	○	○	○	○	○	○	○
Computer Studies	○	○	○	○	○	○	○	○	○	○	○

Figure 2.6 shows the percent of twelfth grade students and the number of years they will have completed in the four most heavily attended courses by the end of high school.

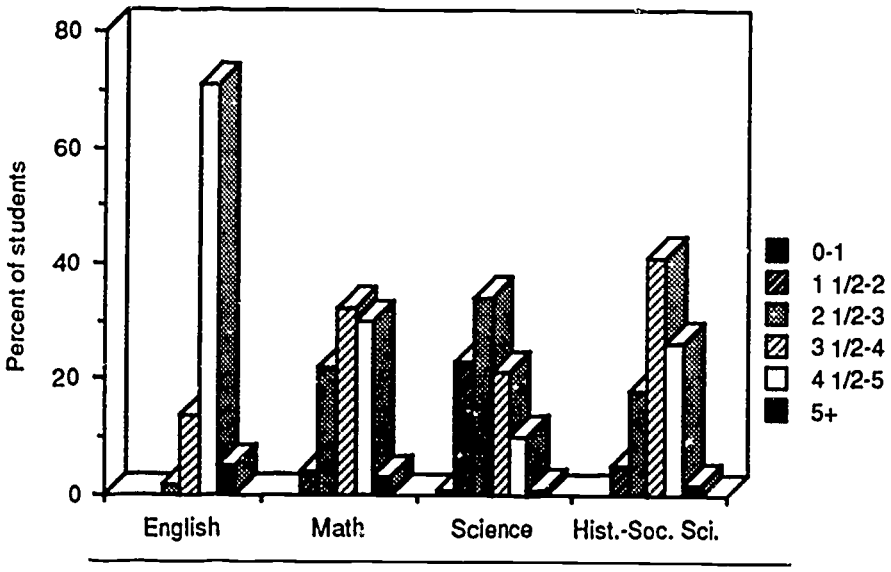


Figure 2.6

Percent of Twelfth Grade Students, by Number of Years of Various Courses Completed

Time Spent Watching Television

Students at grades six, eight, and twelve are asked to provide information on the amount of time they spend watching television. The question students respond to is identical at all three grade levels: "On a typical weekday, approximately how many hours do you spend watching TV?" Figure 2.7 shows the percent of sixth, eighth, and twelfth graders by the various amounts of time spent watching television. (See Figure 3.39 in Chapter 3 of this report for reading scores of eighth grade students by time spent watching television.)

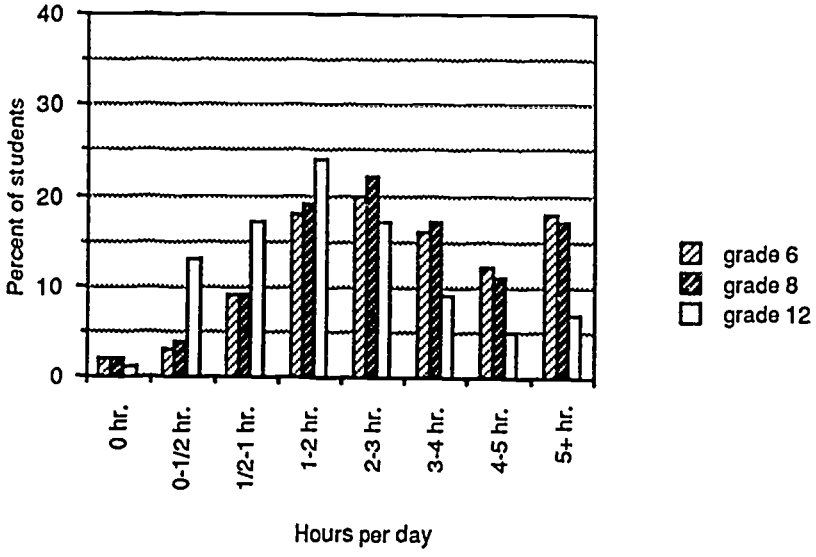


Figure 2.7

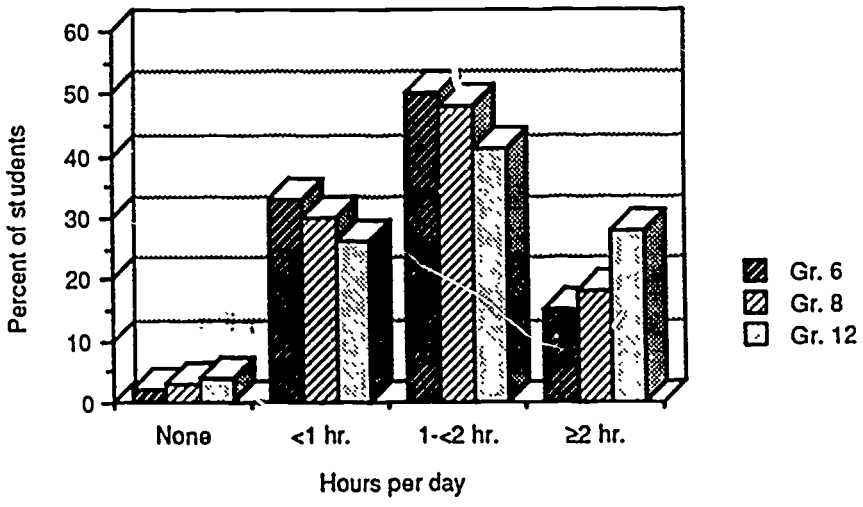
Percent of Sixth, Eighth, and Twelfth Grade Students, by Time Spent Watching TV

Time on Homework

At grades six, eight, and twelve, students are asked to answer the following question: "How much time do you usually spend outside of school doing homework each weekday?" Figure 2.8 shows the statewide responses to that question. (See Figure 3.38 in Chapter 3 of this report for reading scores of eighth grade students by time spent on homework.)

Figure 2.8

Percent of Sixth, Eighth, and Twelfth Grade Students, by Time Spent on Homework

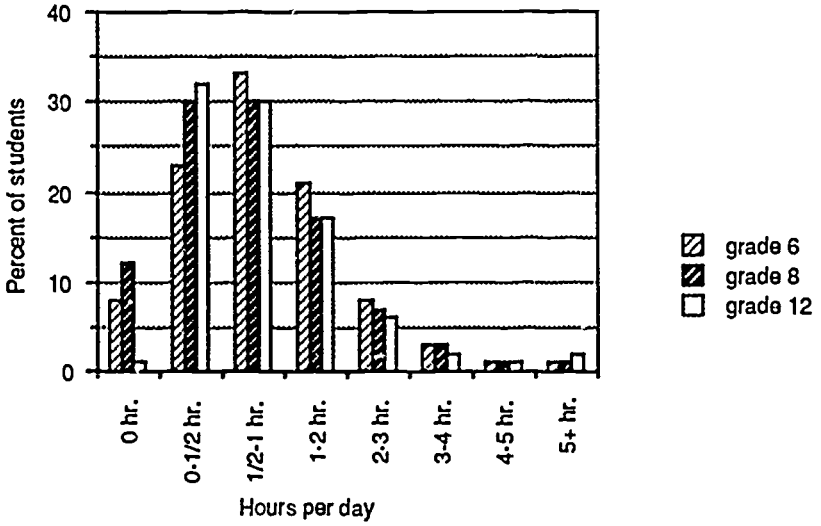


Time Reading for Pleasure

Sixth, eighth, and twelfth grade students supply information on the amount of time they spend reading for pleasure. The question at each grade level is as follows: "On a typical weekday, approximately how many hours do you spend reading for pleasure?" The percents of students responding to each time category are shown in Figure 2.9. (See Figure 3.37 in Chapter 3 of this report for grade eight reading scores by time spent reading for pleasure.)

Figure 2.9

Percent of Sixth, Eighth, and Twelfth Grade Students, by Time Spent Reading for Pleasure



Number of Writing Assignments

Sixth and eighth grade students are asked to respond to the following question on writing assignments: "How many reports and papers have you written during the last six weeks as part of any school assignment?" Figure 2.10 shows the percent of sixth and eighth grade students by the various numbers of writing assignments reported.

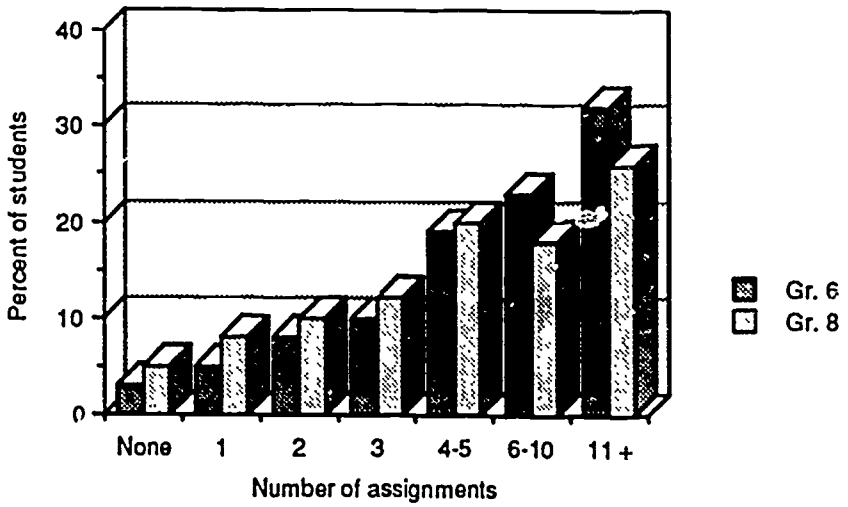


Figure 2.10

Percent of Sixth and Eighth Grade Students by Number of Writing Assignments Written during Last Six Weeks

Twelfth grade students also respond to a question pertaining to writing assignments: "How many writing assignments do you usually complete each week for school?" The percent of twelfth grade students and the corresponding number of writing assignments completed appear in Figure 2.11.

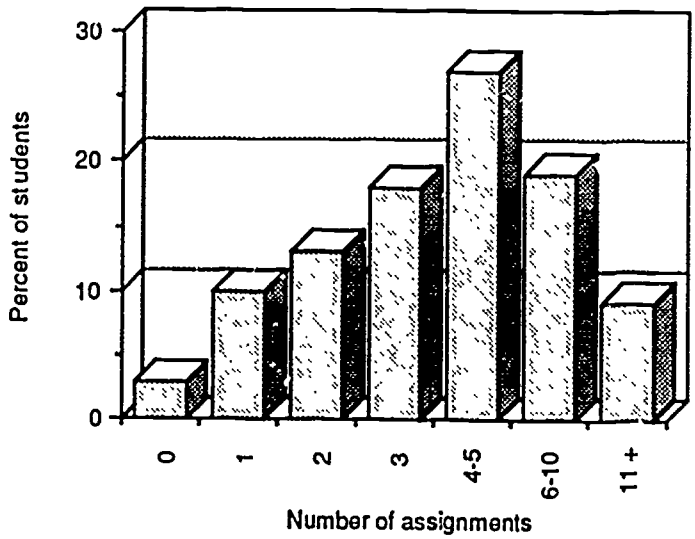


Figure 2.11

Percent of Twelfth Grade Students, by Number of Writing Assignments Written Each Week

Local Subgroup Reports

This chapter has thus far focused on student demographic information for statewide results; however, as mentioned earlier in this chapter, this type of information is also presented in the CAP school and district reports in the section titled "Student Subgroup Results." In a school-level report student subgroup information is reported for that school, for the school district, and for the entire state, thereby making comparisons at various levels possible (see Figure 2.12). Notice that demographic information can be provided not only for the total student population but also for subgroups of students. For example, in Figure 2.12, the data on writing assignments are given for SES (parents' education) groups.

Figure 2.12

Sample Table from *Grade 8 School Report*, "Student Subgroup Reports" Section

This table displays, by parent education, the percent of students who wrote various numbers of reports and papers the previous six weeks as part of any school assignment.

Interpretive Example

At your school, 13 percent of the students who indicated that they have parents who are "College Graduates" reported writing 3 reports and papers during the last six weeks.

Number of reports and papers written during last six weeks	SCHOOL						DISTRICT						STATE					
		Parent Education						Parent Education						Parent Education				
	Students %	Adv Deg %	Coll Grad %	Some Coll %	H.S. Grad %	Not H.S. Grad %	Students %	Adv Deg %	Coll Grad %	Some Coll %	H.S. Grad %	Not H.S. Grad %	Students %	Adv Deg %	Coll Grad %	Some Coll %	H.S. Grad %	Not H.S. Grad %
None	6	2	1	5	7	15	8	5	5	7	10	9	5	2	4	4	6	10
1	6	7	1	5	7	15	8	5	7	8	10	11	8	5	6	7	9	10
2	9	2	12	9	14	7	13	6	15	12	14	14	10	8	9	10	11	11
3	12	5	13	11	15	16	16	12	16	17	15	22	12	11	12	12	13	13
4 - 5	22	18	23	19	23	18	21	28	22	19	19	18	20	20	20	20	20	19
6 - 10	16	20	17	23	11	11	14	19	14	15	15	10	18	22	20	19	17	15
11 or more	28	45	33	26	23	18	20	24	21	22	17	16	26	31	27	27	23	22

Chapter 3

ENGLISH/LANGUAGE ARTS

In this chapter the results of the California Assessment Program reading and written expression tests are integrated to reflect the consolidation of the language arts in the new *English/Language Arts Framework*. CAP assesses reading and written expression at grades three, six, eight, and twelve. Members of the Reading Assessment Advisory Committee and the English Language Assessment Advisory Committee (members' names are listed in Appendix C) have worked together to relate and integrate the reading and written expression test results at each grade level. The test results and analyses of both areas are presented together here to show that relationship.

There are strong relationships between the specific skills within reading and written expression (see Figure 3.1). For example, vocabulary is tested in the reading tests, and language choices (selecting the most effective word for a given context) is tested in the written

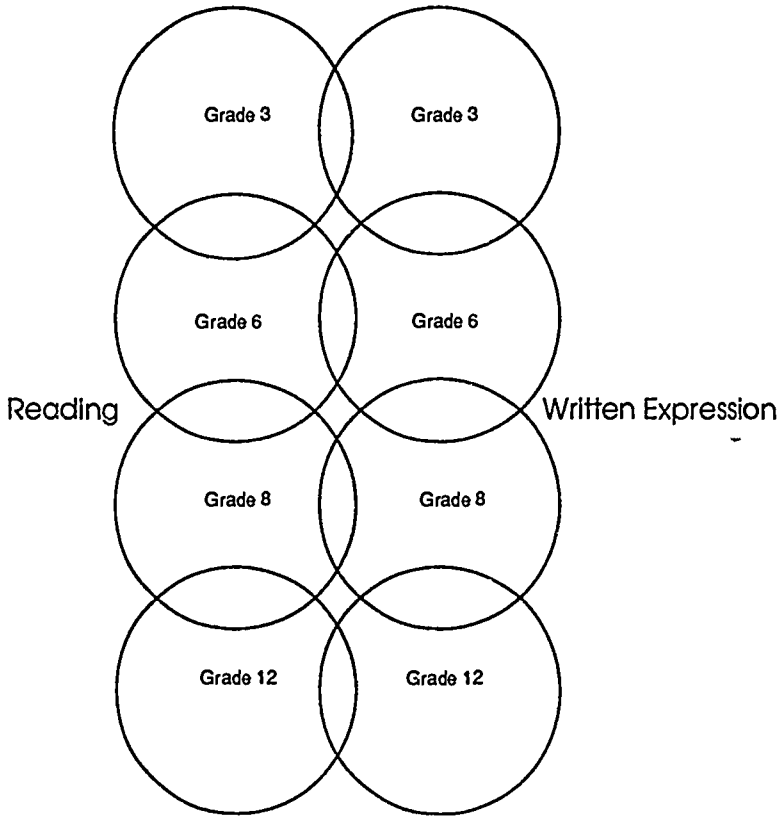


Fig. 3.1

Interrelationship Between Reading and Written Expression Tests

This illustration suggests the interrelatedness of the reading and written expression tests across the grades.

expression tests. Following textual organization is tested as a reading skill; improving organization is tested as a written expression skill. Critical/applicative comprehension questions require students to think critically about a science, social studies, or literary selection on the reading test; critical judgment questions on the written expression tests require students to think critically about the strengths and weaknesses in a given student essay.

The reading and written expression tests at all grade levels also contain a basic skills component and a critical thinking component. The reading tests at each grade level assess literal comprehension (questions that are explicitly answered in the text), and higher-order comprehension (questions that require students to make inferences and judgments). Each of the written expression tests includes supporting skills (questions involving matters of correctness and convention, such as punctuation, capitalization, and usage) and writing process skills (questions that involve matters of judgment in such areas as word choices, sentence style, and paragraph development).

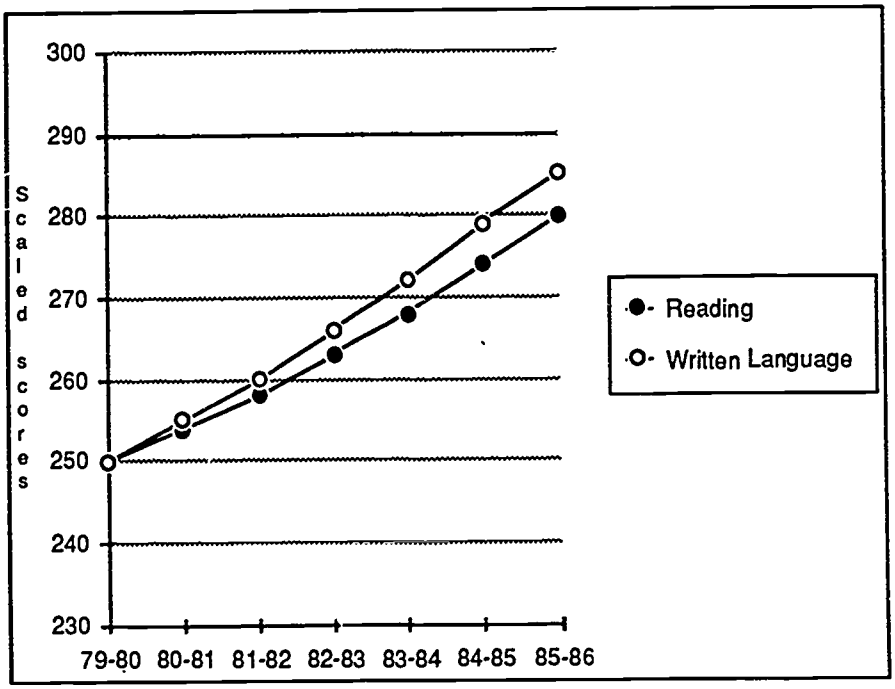
Overall Results

Scores increased on all 1985-86 CAP tests in English/language arts except the grade twelve reading test. This year's results, as well as results since 1979-80 (or when the test was first administered) at each grade level, are shown in figures 3.2 through 3.5.

Fig. 3.2

Grade Three Reading and Written Language Scores, 1979-80 Through 1985-86

At grade three, reading and written language scores have improved for six consecutive years.



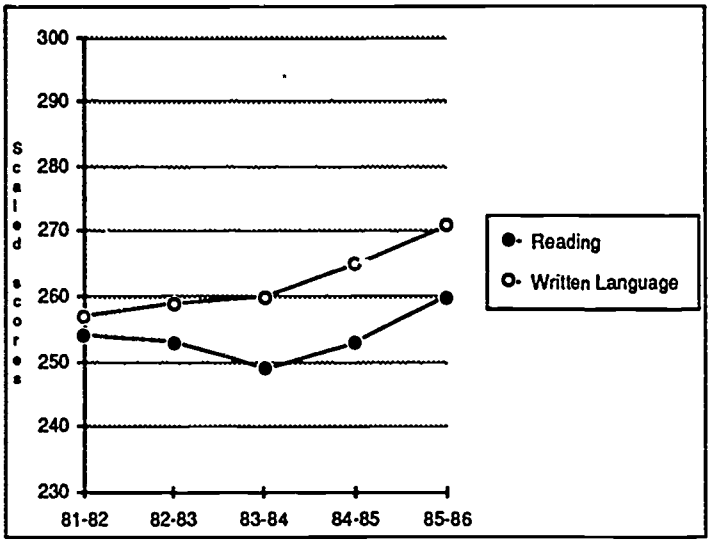


Fig. 3.3

Grade Six Reading and Written Language Scores, 1981-82 Through 1985-86

At grade six, written language scores have improved for four consecutive years, and reading scores have improved for the last two years.

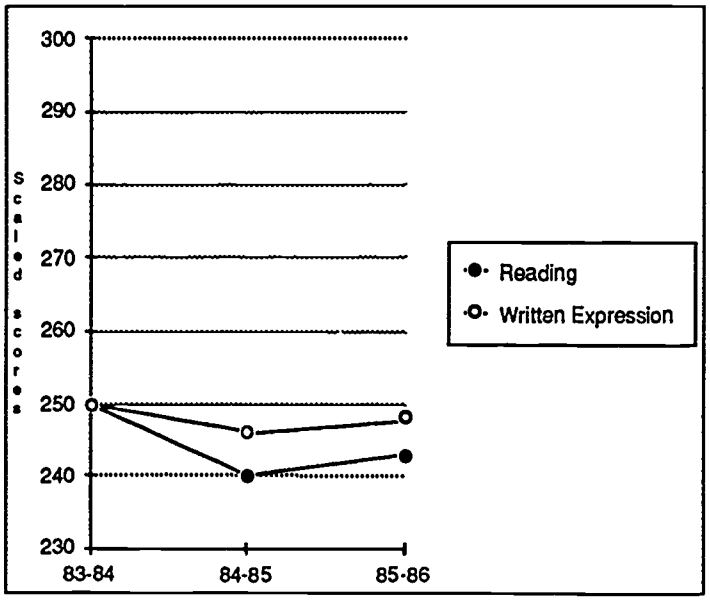


Fig. 3.4

Grade Eight Reading and Written Expression Scores, 1983-84 Through 1985-86

At grade eight, the 1985-86 reading and written expression scores improved from the previous year, but failed to reach the levels attained in 1983-84.

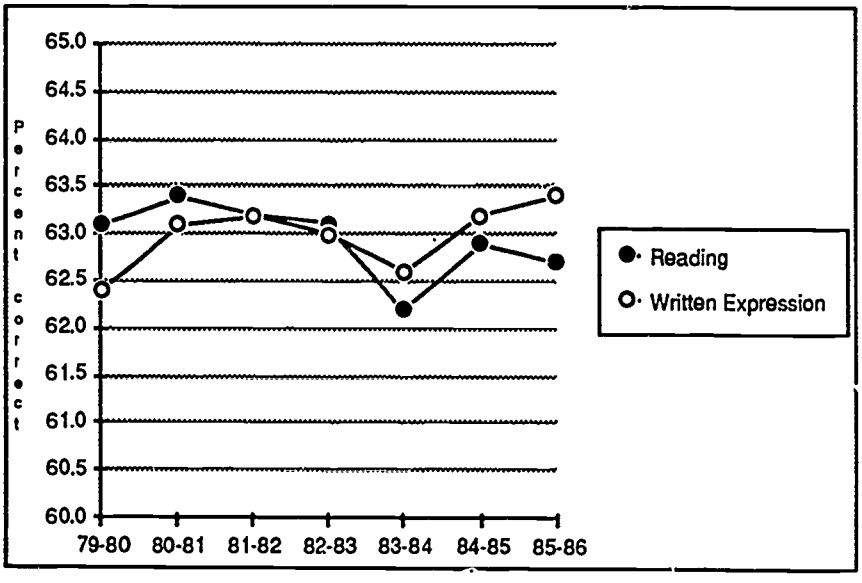


Fig. 3.5

Grade Twelve Reading and Written Expression Scores, 1979-80 Through 1985-86

At grade twelve, written expression scores improved for the second consecutive year, while reading scores declined from 1984-85.

Findings

This section is organized around nine findings by the statewide advisory committees. The committee members derived these findings from three primary considerations: (1) percent correct scores of the skill areas tested as compared to other skill area results and to the total test score for a content area; (2) the extent to which scores for a given element have changed from year to year; and (3) the importance of the various skill areas tested as suggested by the model curriculum standards and guides. (The nine findings and their corresponding recommendations are summarized at the end of this chapter.) Working with the extremely rich data source of two tests at four grade levels, members of the committees were especially sensitive to recurring patterns in the test results. The findings are accompanied by graphs of appropriate supporting data, illustrative test questions, and brief recommendations, aimed primarily at classroom instruction. The correct answer for each illustrative question is marked by a percent value indicating the percentage of students who answered the question correctly. The complete tables of data for the current year and all previous testing years are contained in Appendix C.

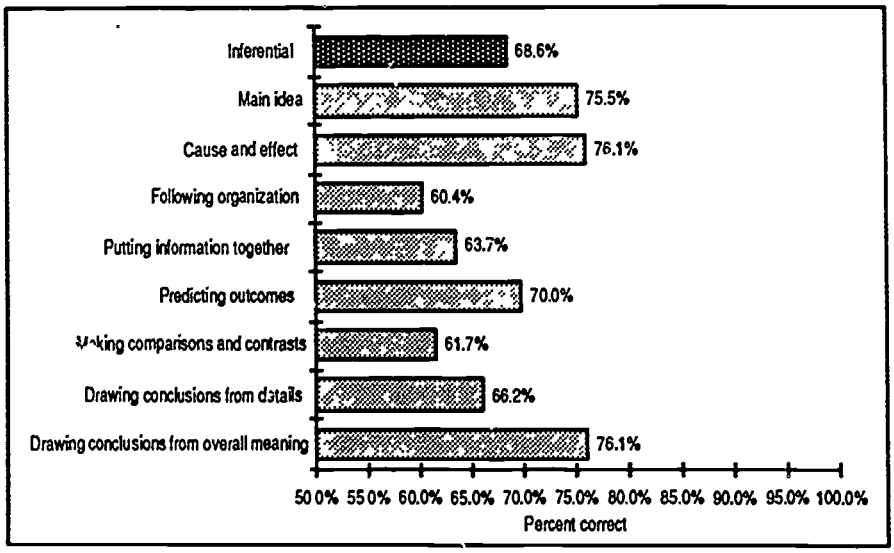
Difficulty with Organization

At grade six and beyond, students have difficulty following or detecting organizational patterns in text. This difficulty increases for students through the grades as they are expected to cope with increasingly difficult texts. For example, sixth grade students scored lowest in the skill area of following organization (see figures 3.6 and 3.7).

Fig. 3.6

Grade Six Inferential Comprehension Skills

Reading questions on following organization were the most difficult type for students to answer on the sixth grade reading test.



Samuel Morse was an inventor. Like many inventors of the 1800s, Morse began experimenting with electricity.

In 1836, Morse developed a system for sending messages over long wires. By stopping and starting an electrical current, the operator could send a short signal, called a dot, or a longer signal, called a dash. Every letter of the alphabet was translated into dots and dashes. This was the birth of the famous Morse Code. The system was the telegraph.

Within ten years, wires were strung fro.. city to city in the United States. In 1861, the western states were linked to the East by telegraph. People were amazed. It had once taken weeks for a letter to travel from the East to the West. Now a message could be sent in a few seconds.

England and other European countries picked up the idea of the telegraph. After many failures, a telegraph line was strung across the floor of the Atlantic Ocean. England's Queen Victoria tapped out the first message to the American President, James Buchanan. A fast communication system now linked Europe and America.

The following outline is based on the entire reading passage. Which point is needed to complete the missing part?

I. Samuel Morse experiments with electricity
II. Morse develops the telegraph syster:
III.
IV. Communication links Europe and America

45% A. The telegraph links eastern and western states
B. Many inventors experiment with electricity
C. Letters of the alphabet are translated
D. Samuel Morse becomes an inventor

Fig. 3.7

Following Organization

This item from the grade six reading test illustrates the difficulty encountered by students in detecting an organizational pattern in a reading passage.

Among the related written expression skills, overall organization registered the lowest score at grade eight (see figures 3.8 and 3.9). Scores in all skill areas under overall organization remain low, and using transitional elements was one of the few skill areas to show a decline (0.1 percent) from 1984-85 to 1985-86 (see Figure 3.10).

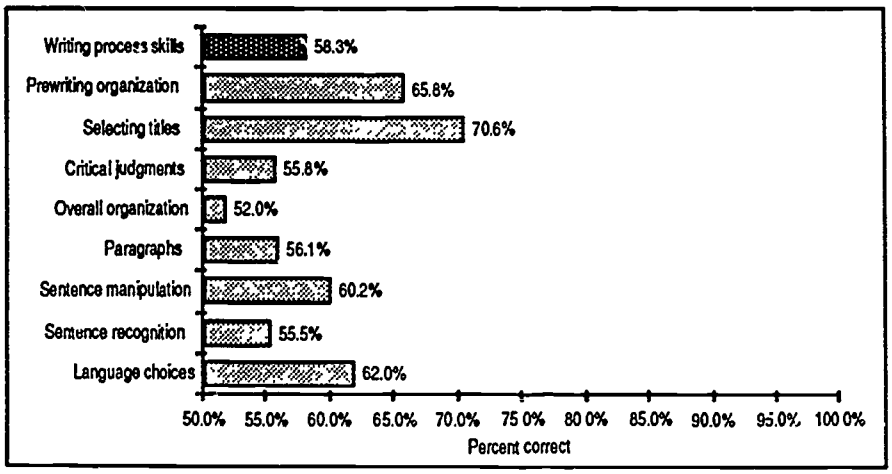


Fig. 3.8

Grade Eight Writing Process Skills

The score for overall organization was the lowest score among the grade eight writing process skills.

The following excerpt is from an essay (written as part of the test develop·ient process) by a student who was asked, as an expert witness before an international commission, to give a presentation on how to preserve an endangered species.

Fig. 3.9

Overall Organization

Only 43 percent of eighth grade students followed the movement of ideas within the paragraph in this example.

"If a species is to survive it must get along with the other members of its species. If a species is a part of the food chain and is endangered by predators, the species is endangered by a natural threat. But the polar bear is at the top of the food chain and has no natural enemies," I said, raising my voice slightly, "and therefore would not be endangered if it weren't for humans."

Which of the following is an accurate statement about the third paragraph (lines 6-10)?

A. The first sentence of the paragraph (line 6) contains the topic sentence.
B. The paragraph moves from specific statements about polar bears to general statements about a species.
C. The second sentence is unrelated to the others.
43% D. The paragraph moves from general statements about a species to specifics about polar bears.

The score for the item in Figure 3.10 from the same test is typical, showing students' unfamiliarity with the use of transitional elements. The excerpt is from an essay written by a student who was asked to compare and contrast generals Lee and Grant.

Fig. 3.10

Transitional Elements

Only 57 percent of the students at grade eight recognized a transitional element between paragraphs—a skill tested as part of overall organization.

As the unknown ending of a long battle drew near, two fine generals waited to see what the outcome would be. They both had ideas of what would be, but there was no certainty. Could General Lee have felt a sigh of relief? Could General Grant have a tinge of excitement because the battle was almost finished?

These men had subtle likenesses. Both showed signs of exhaustion, which represented their hardships, losses, gains, and defeats. Their weathered, tired faces showed what they had seen—the conquest of another army or the slaughter of their own young men. Both men were, indeed, in a sense, enemies, but showed no lack of respect. "Appreciation" may not have been the word—but a basic mutual respect was present. These men were like boys playing a big game, a game that does not always end in a happy way.

Which of the following word groups in line 5 connects the second paragraph to the first paragraph?

57% A. These men
B. had subtle
C. showed signs
D. of exhaustion

Recommendation: Students should practice with a wide variety of organizational patterns and literary genres in reading and writing instruction.

Writing Process Skills Weak

Students tend to have more difficulty with the writing process skills (involving matters of judgment) than with the supporting skills (involving matters of correctness). There is evidence for this finding at every grade level (see figures 3.11 through 3.15).

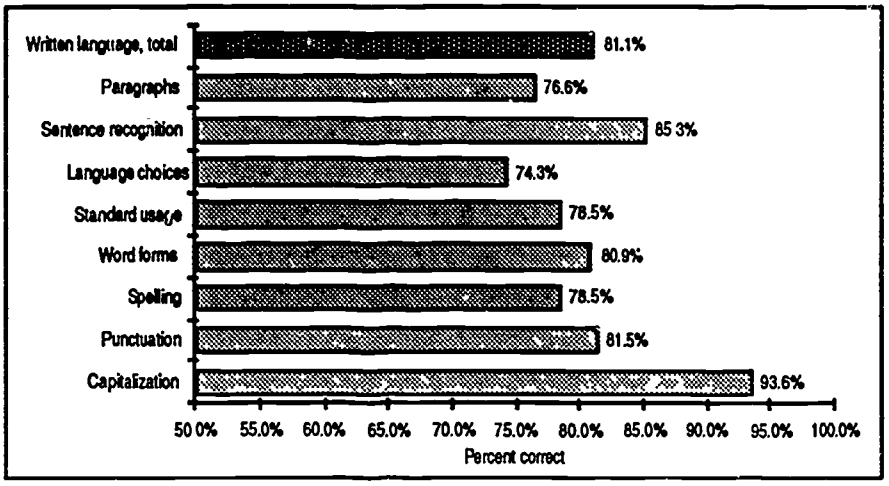


Fig. 3.11

Grade Three Written Language Skill Areas

At grade three, two of the three writing process skills (paragraphs and language choices) registered lower scores than any of the five supporting skill areas.

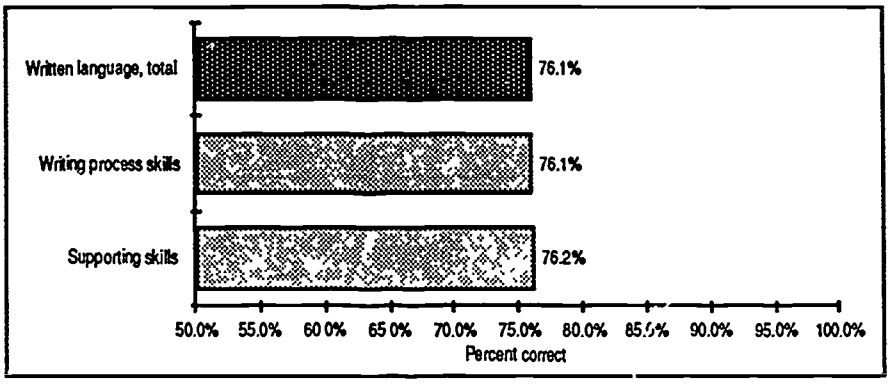


Fig. 3.12

Grade Six Written Language Skills

At grade six, the writing process skills were slightly below the supporting skills (compare with Figure 3.13).

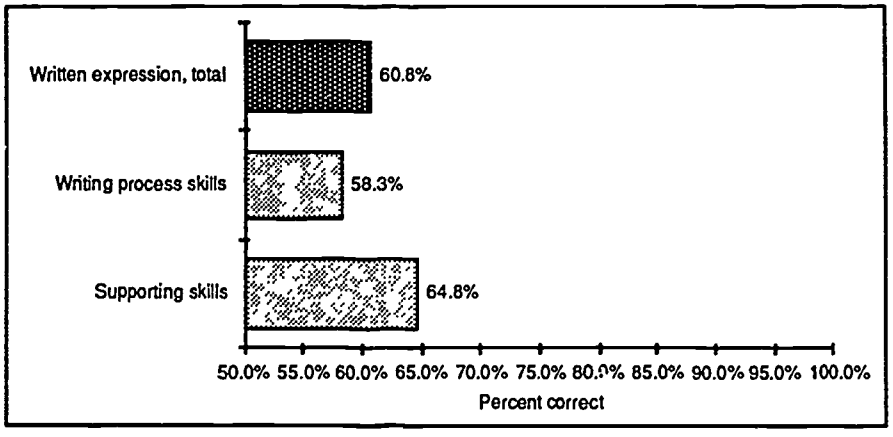


Fig. 3.13

Grade Eight Written Expression Skills

At grade eight, the score for writing process skills fell well below the score for supporting skills (compare with Figure 3.12).

At grade twelve scores for only two skills areas fell below the total written expression score. Both are writing process skills. All the supporting skills scores were above the written expression score.

Fig. 3.14

Judging Student Writing

This grade six item on judging student writing is an example of the writing process questions, on which students scored lower than on supporting skills. Here the score is nearly 20 percentage points below the overall written language score.

It would supply enough food for everyone in the world. At present, millions go to bed hungry every night. Thousands actually die of starvation each day. As the number of people on earth grows, food becomes more and more scarce. For these reasons, I wish I could invent a food-making machine.

Suppose your brother wrote the above essay. What advice would you give him to improve it?

A. Tell about some favorite foods.
57% B. Add an opening sentence that states the topic.
C. Give some information about hunger.
D. Round out the ending with a more definite conclusion.

Fig. 3.15

Irregular Verbs

This grade six item is typical of supporting skills items, on which students scored well.

The curtains in the house on the corner _____ bright yellow.

A. is
B. was
78% C. are
D. has always been

Recommendation: Students need more practice with the process of writing. Supporting skills instruction should be integrated into that process during the editing phase of composition instruction. Emphasis should be placed on helping the student to present his or her message clearly to a given audience.

Difficulty with Higher-Order Comprehension

At grades six, eight, and twelve, students had more difficulty with high-order comprehension involving inferences, interpretations, and critical thinking than they did with literal comprehension (see Figure 3.16).

Fig. 3.16

Literal Versus Interpretive Comprehension

Every day when school let out at three o'clock, I'd get into an old pair of sneakers and a T-shirt and gym shorts and run around that block. In the beginning, I'd just run for an hour, then go and take a hot shower. And then one day two girls walked by, and one of them said, "What's he think he's doing?"And the other one said, "Oh he must be training for the big races." I just kept running that day, around and around the block, until every time I hit the pavement pain shot up my leg, and a needle went into my side, and I kept going around and around until I was numb, and I didn't feel anything more. Suddenly, it was dark, and the track team had all left. I could hardly walk home my feet hurt so much, but I couldn't wait to get out there again. Maybe I couldn't run as fast as the other guys, but I could run longer, longer than anybody else in all of the city of St. Louis. And then everybody would know who I was.

I kept running all that fall and all that winter, sometimes through the snow, until everybody in school knew who I was, the guy who never took a rest from three o'clock until six o'clock. I don't think I ever would have finished high school without running. It was something that kept me going from day to day, a reason to get up in the morning, to sit through classes with the Helene Tuckers and the doctors' sons who knew all the answers and read books at home, to look forward to going a little faster and a little longer at three o'clock. And I felt so good when I ran, all by myself like a room of

my own. I could think anything I wanted while I ran and talked to myself and sometimes I'd write stories on "My Favorite Daddy" and "What I'd Buy with a Million Dollars," and I could figure out why people did certain things and why certain things happened. Nobody would point to me and say I was poor and crazy; they'd just look at me with admiration and say, "He's training." I never got hungry while I was running, even though we never ate breakfast at home, and I didn't always have money for lunch. I was never cold or hot or ashamed of my clothes. I was proud of my body that kept me going around and around and never had to take a rest.

What did the author wear when he ran?

A. a warm-up suit and running shoes
91% B. sneakers, a T-shirt, and gym shorts
C. sweat pants, a sweat shirt, and tennis shoes
D. jeans, a T-shirt, and no shoes

The mood at the end of the passage is one of

A. frustration because of failure.
B. conceit based on a life of ease.
C. dullness because of boredom.
81% D. confidence achieved through struggle.

The first item (from the grade eight reading test) is illustrative of items assessing literal comprehension. Students at grades six, eight, and twelve scored higher on such items than on items assessing higher-order comprehension, such as in the second item. The second item assesses the understanding of mood under interpretive comprehension.

Recommendation: Use and build on students' background knowledge in prereading and prewriting activities to help them learn to make inferences as they read and write.

Science Comprehension Low

Students have greater difficulty with comprehension of science passages than with comprehension of literature or social studies passages at grades six and eight (see figures 3.17 and 3.18).

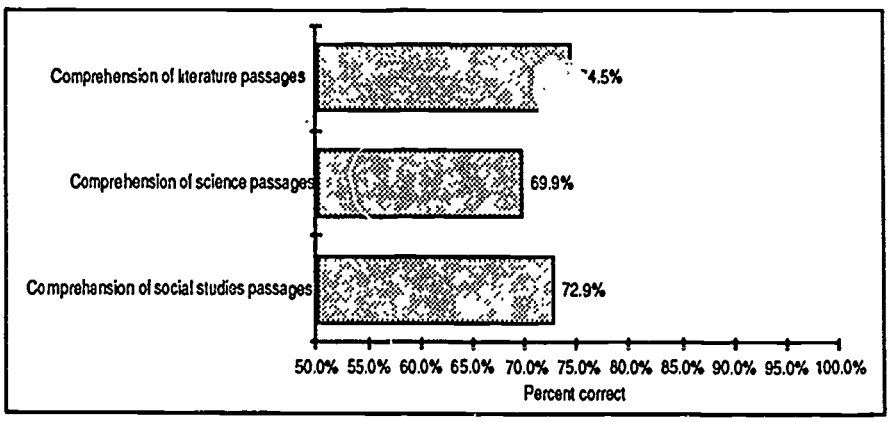


Fig. 3.17

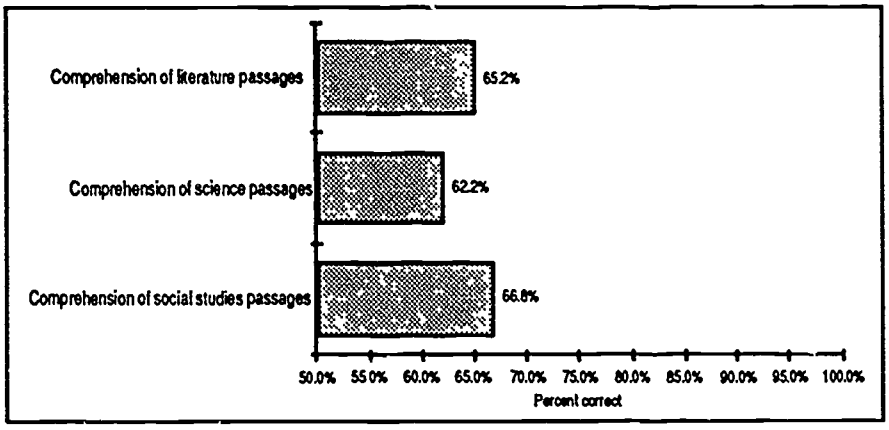
Grade Six Scores for Reading in the Content Areas

At grade six, the overall score for comprehension of science passages was lower than the comprehension scores for social studies and literature passages.

Fig. 3.18

Grade Eight Scores for Reading in the Content Areas

At grade eight, the score for comprehension of science passages was lower than comprehension of social studies and literary passages. These results are consistent with the grade six results.



Recommendations: Science should be a greater part of the instructional program at all grade levels from kindergarten through grade eight. Active experience in science should precede vocabulary learning and concept building.

Sentence Combining Skills Weak

At grades three and six, students demonstrate a mastery of rudimentary sentence recognition skills such as supplying sentences with subjects and verbs. At grade six and beyond, however, students have more difficulty combining sentences effectively and discriminating among fragments, run-ons, and complete sentences. Sentence combining, while low, registered the highest gains at grade six since 1981-82 . (See figures 3.19 through 3.26.)

Fig. 3.19

Grade Three Skill Areas In Written Expression

Third graders scored very high on sentence recognition questions.

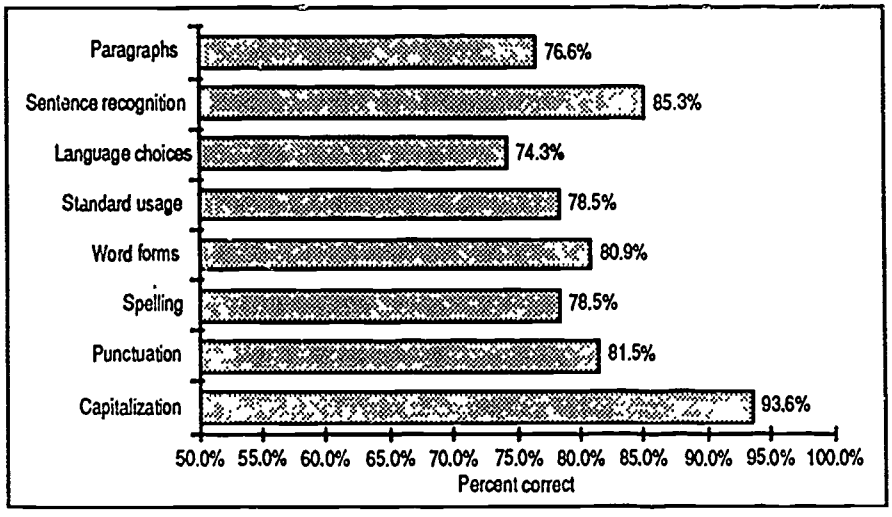


Fig. 3.20

Supplying Subjects and Verbs

This grade three written language item is illustrative of students' mastery of rudimentary sentence skills.

The old oak door _____.

A. during the night
B. inside the house
C. back and forth
83% D. squeaked all day

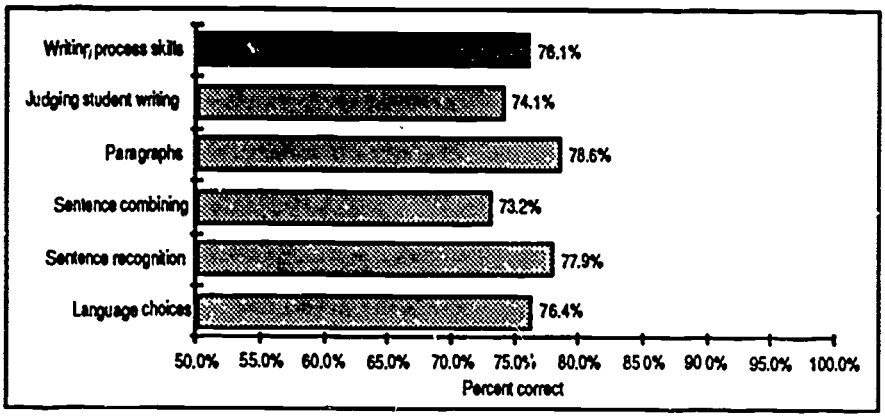


Fig. 3.21

Grade Six Writing Process Skills

Sentence combining is the most difficult writing process skill for sixth graders.

The people were running in the _____.

A. theater, I thought there might be a fire
B. theater. Am thinking there might be a fire
C. theater. When I thought there might be a fire
46% D. theater. I thought there might be a fire

Fig. 3.22

Recognizing Complete Sentences

This grade six written language item illustrates the difficulty students at grade six and beyond have in identifying complete sentences.

1. Francis Scott Key was a writer.
2. The writer was American.
3. The writer was a lawyer.
4. The writer created "The Star-Spangled Banner."

66% A. Francis Scott Key was an American lawyer and writer who created "The Star-Spangled Banner."
B. Francis Scott Key was a writer, and an American, and a lawyer, and he also created "The Star-Spangled Banner."
C. Francis Scott Key was a writer and an American, and Francis Scott Key was a lawyer and created "The Star-Spangled Banner."

Fig. 3.23

Sentence Combining

This grade six item is illustrative of sentence combining items, where scores have improved steadily for the last four years.

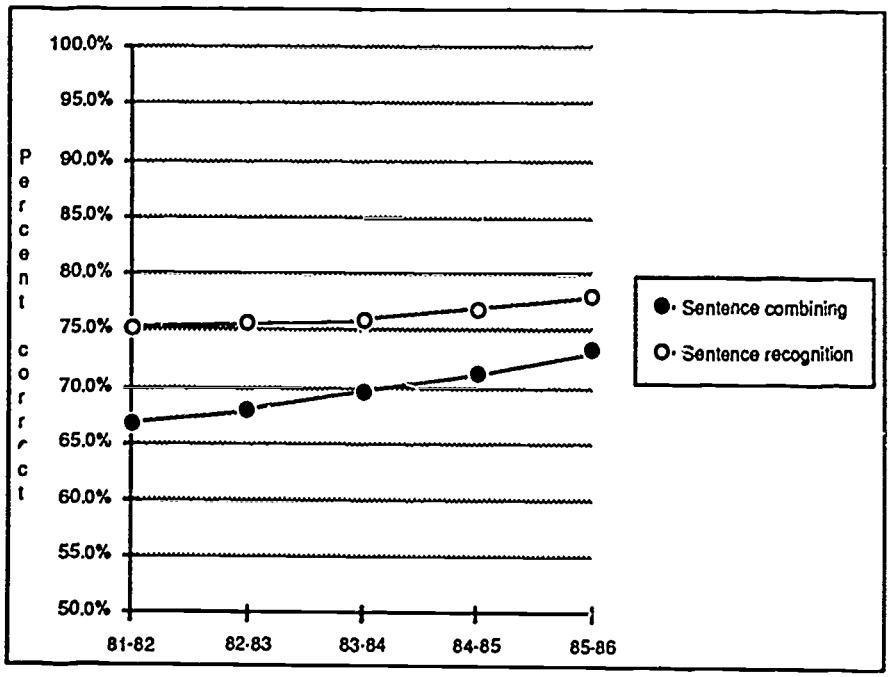


Fig. 3.24

Grade Six Sentence Combining and Sentence Recognition, 1981-82 Through 1985-86

The score for sentence combining, while low, has shown the greatest gain of all grade six written language skills tested over the last four years.

Fig. 3.25

Grade Eight Writing Process Skills

At grade eight, sentence recognition, which requires discrimination among fragments, run-ons and complete sentences, is one of the most difficult areas for students.

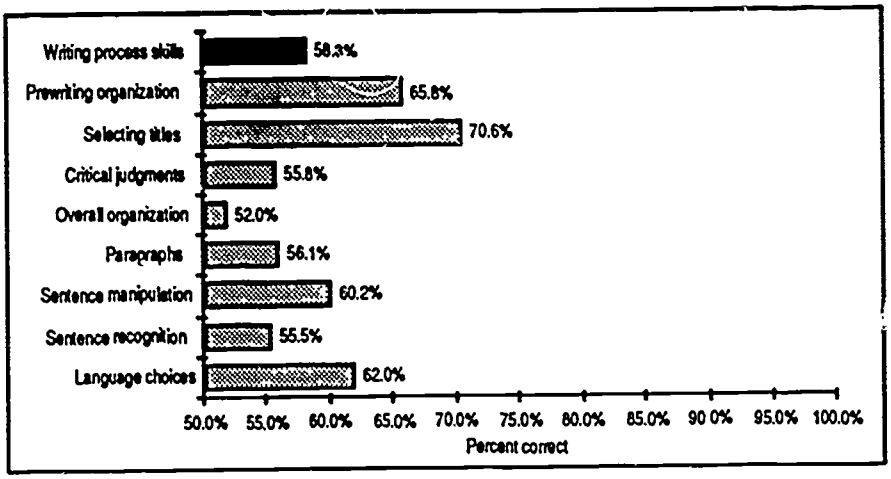


Fig. 3.26

Grade Eight Sentence Combining and Recoginition

The first grade eight written expression item, which assesses the identification of complete sentences, illustrates students' difficulty in discriminating between fragments, run-ons, and complete sentences. The second is illustrative of the low scores in the skill area of sentence combining.

1 *May 31, 1769*
2 *Today, finally, we have found a fresh water source. Our brave captain, Gaspar de*
3 *Portola, has made the decision to rest awhile and then continue our journey.*
4 *Our thoughts have turned quickly to a shelter and a steady supply of food. One of our*
5 *men saw a bear as large as a man! It took three shots to bring the huge beast down! Per-*
6 *haps Father Serra's choice to stay here was not as foolish as I'd thought.*
7 *Many men have begun the construction of our shelter. With only two axes, we have*
8 *felled four of the mighty trees that surround our chosen site. We have also found a great*
9 *many fruit-bearing trees that will lessen our need to hunt more of the fierce bears or fast*
10 *deer.*
11 *If we do succeed in finishing our shelter and repairing our poor ship, I will journey*
12 *back to our home country to bring more men and establish trade routes. I have no*
13 *intention of returning here if I do make it back. Here, the life is hard. When I get home, I*
14 *will be greeted as a hero and live a life of luxury, one of my fondest secret dreams.*
15 *For now I must begin my turn at the axe.*

The underlined statement in line 2 is

A. a run-on sentence.
B. a sentence fragment.
53% C. a correct sentence.

Which of the following is the clearest and most logical revision of the sentence in lines 13-14?

A. A life of luxury, one of my fondest secret dreams, is at home to be greeted as a hero.
B. To be greeted as a hero and live one of my fondest secret dreams, when I get home, a life of luxury.
58% C. One of my fondest secret dreams is to be greeted as a hero and live a life of luxury when I get home.

Recommendation: Knowledge of sentence limits grows slowly and is best acquired through extensive reading and oral language experience such as active discussion, oral reporting, and choral reading. Such oral language activities will reinforce the ability to cope with more complex sentence structures.

Word Meaning Difficulties

At grade three, students have difficulty using context to determine word meanings, but at grades six and eight, students are stronger at using context and weaker in their knowledge of word meanings in the content areas. This weakness is also evident at grade twelve, where vocabulary scores have declined for eight out of the last ten years.

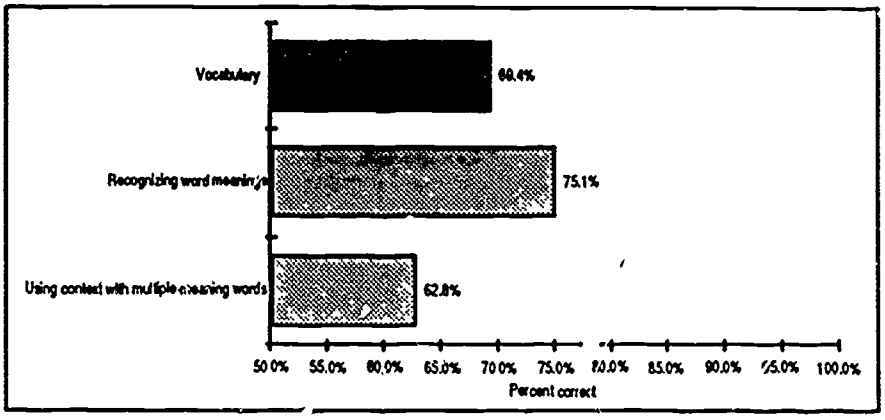


Fig. 3.27

Grade Three Reading Vocabulary

Using context is a difficult skill area for third graders.

Once a fox met a stork. "Friend Stork," he said, "I should like to have you come to my house for dinner tomorrow."

The next day when the stork came, all that the fox had for dinner was soup served in a shallow dish. The stork could not drink from a shallow dish, so the fox drank all the soup while the stork watched.

"Don't you like soup, Friend Stork?" asked the fox. "I'm so sorry." So the stork went home hungry.

The next week, the stork asked the fox to come and have dinner with her.

"I shall be glad to come," said the fox.

The stork served soup also, but she served it in a deep jug. The stork could reach the soup very easily with her long bill, but the fox couldn't get even one mouthful. He was very angry about it.

"Oh do not be so cross, Mr. Fox," laughed the stork. "I think that you have enjoyed my dinner as much as I enjoyed yours."

In this story, bill means

Grade 3	Grade 6	
		A. a check.
		B. something to pay.
		C. a boy's name.
68%	*91%*	D. a beak.

Fig. 3.28

Using Context in Vocabulary

This passage and item appear on both the third and sixth grade reading tests. The item is illustrative of the fact that students display substantially greater strength at grade six than at grade three in using context to determine word meanings.

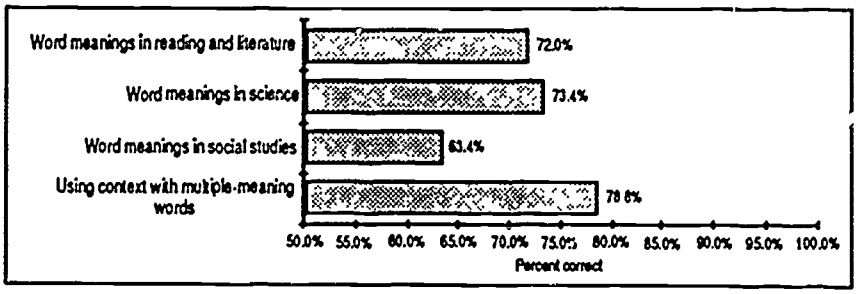


Fig. 3.29

Grade Six Word Meanings in the Content Areas

Questions assessing knowledge of word meaning present more difficulty for sixth graders than questions assessing use of context.

Fig. 3.30

Knowledge of Word Meanings

This social studies vocabulary item, used on the sixth and eighth grade tests, illustrates the difficulty students have in coping with word meanings in specific content areas.

The term Democracy means

Grade 6	Grade 8	
9%	6%	A. government in which a person is born with the powers of the president.
19%	14%	B. government in which all people must belong to the Democratic Party.
46%	*60%*	C. government by the representatives who are elected by the people.
30%	21%	D. government in which only the educated can vote.

Recommendation: Vocabulary learning must be presented in many different contexts through wide reading and listening activities. Instructional strategies should include a focus on vocabulary building.

Difficulty Choosing Specific Words

Students have difficulty selecting the most specific language for a given context at grades three and six (see figures 3.31 through 3.33). Scores in this skill area declined at grade eight from 1984-85 to 1985-86.

Fig. 3.31

Grade Three Language Choices

Selecting the most specific word for a given context is one of the most difficult skill areas for third graders.

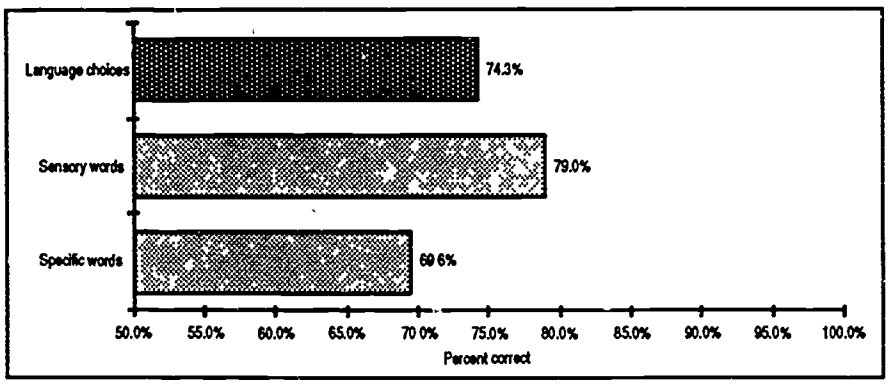


Fig. 3.32

Selecting Specific Language

This grade three item is typical of the difficulty third, sixth, and eighth grade students have in selecting specific language.

Choose the one that tells exactly what Bess heard.

	A. something
	B. some noise
62%	C. a whisper

Fig. 3.33

Language Choices

This language choices item, referring to a student essay on the grade eight test, illustrates the downward trend in scores for items of this type.

Which of the following changes, if any, would be a more specific word choice than *scientists* (line 17)?

83-84	85-86	
		A. Change *scientists* to *persons of learning.*
		B. Change *scientists* to *investigators.*
57%	*53%*	C. Change *scientists* to *astronomers.*
		D. Leave as is.

Recommendation: Students need to learn how to achieve greater specificity in their writing and to judge where greater specificity is needed and where a more general term is more appropriate.

Critical Thinking Weak

Critical comprehension in reading (see Figures 3.34 through 3.36) and critical judgments in written expression were identified as areas of weakness.

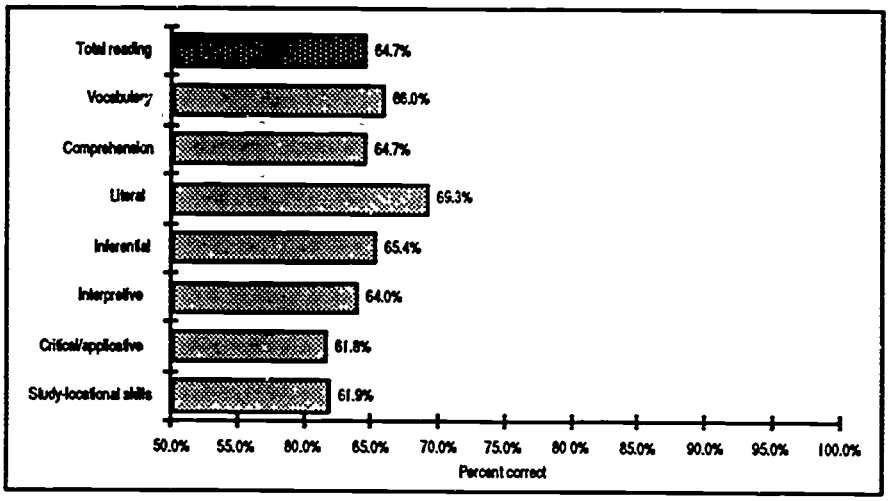


Fig. 3.34

Grade Eight Reading Skill Areas

The score for critical/ applicative comprehension was the lowest of all skill area scores on the grade eight reading test.

There was once a desert nomad who rode into town and saw a pair of boots offered for sale in the market. He went into the shop and made an offer for them, but Hunain the shoemaker stuck to his price, and in the end the infuriated nomad stomped out of the shop. "The price you ask is equal to the value of my camel," he snorted.

Now the shoemaker was deeply offended by the behavior and language of this nomad and decided that he would not let him get away with such insults. The nomad had mounted his camel and started along the trail towards the tents of his tribe. The shoemaker, knowing from where his would-be customer had come, picked up the boots and went by shortcuts to a point that the nomad would have to pass eventually. There he placed one boot on the sand.

Then the shoemaker went a mile or more farther along the road and dropped the other boot, hiding himself to watch what would happen, for he had a plan.

Presently the nomad came along and saw the first boot lying on the ground. He said to himself, "That is one of the boots of Hunain, the cobbler; if only it was a pair, I would be able to get down and take them away for nothing." And he went on his way. After all, what was the use of one boot?

Soon afterwards, of course, the nomad came upon the second boot. He thought, "What a pity I did not take up the first one—then I would have a pair." Then it occurred to him that he might go back for the first boot; then he would have them both.

The nomad was some way from his own tents and did not want to tire his camel, so he hobbled it and ran back to the place where he had seen the first boot.

The shoemaker came out of hiding and, leaving the second boot where it was, he made off with the nomad's camel.

When the nomad arrived back to the place where he had left his camel, he found it missing. Thinking it must have strayed, he made his way back to the tents of his people.

"What have you brought back from town?" his fellow nomads asked, as he limped into the settlement.

"Only the boots of Hunain," said the miserable man.

Fig. 3.35

Critical/Applicative Comprehension

The low score on this grade eight item assessing knowledge of author's purpose illustrates the need for more emphasis on critical thinking skills in reading.

The author's purpose in writing this story is to

49% A. teach a lesson about human nature.
B. present facts about a tribe.
C. teach a lesson about modesty.
D. present information about a craft.

The following excerpt is from an essay written by a student who was asked to pretend to be a member of Father Serra's party and write a journal entry describing the surroundings and the secret hopes and fears based on the day's events.

11 *If we do succeed in finishing our shelter and repairing our poor ship,I will journey*
12 *back to our home country to bring more men and establish trade routes. I have no*
13 *intention of returning here if I do make it back. Here, the life is hard. When I get home, I*
14 *will be greeted as a hero and live a life of luxury, one of my fondest secret dreams.*

Which of the following is a contradiction in the essay?

A. seeing a bear as large as a man and needing three shots to kill it
48% B. saying he will bring back more men yet having no intention of returning
C. cutting down four trees with only two axes
D. needing fresh water when they have traveled by boat

Fig. 3.36

Critical Thinking in the Writing Process

In this item students did not analyze carefully to see the contradiction.

Recommendation: Students need to use vocabulary and information in many contexts to gain experience detecting logical contradictions and discovering how changes in context determine shifts in meaning.

Reading, Television, and Homework

Higher test scores are related to more time reading for pleasure, more homework, and less television watching, as illustrated in figures 3.37 through 3.39, respectively.

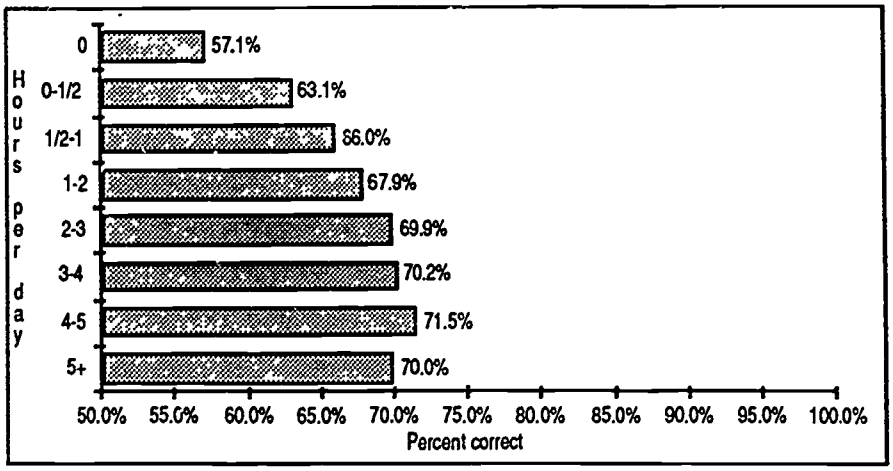


Fig. 3.37

Grade Eight Reading Scores by Time Reading For Pleasure

Higher reading scores are associated with greater amounts of time reading for pleasure.

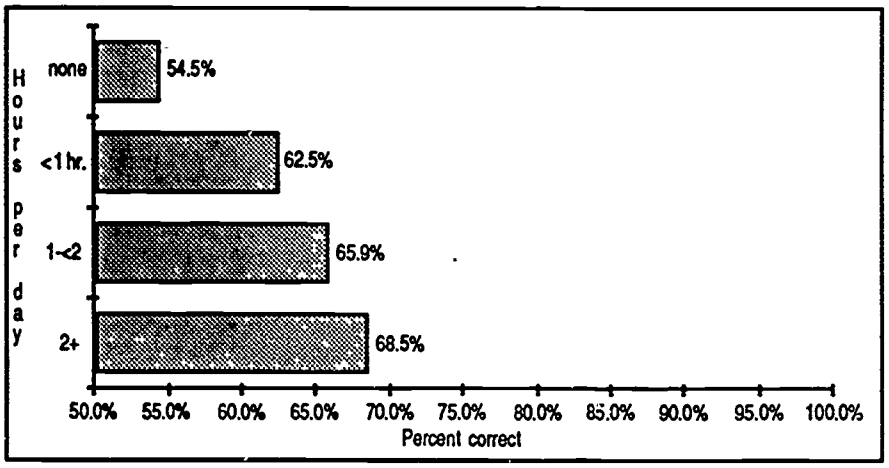


Fig. 3.38

Grade Eight Reading Scores by Time Spent on Homework

Higher reading scores are associated with greater amounts of time on homework.

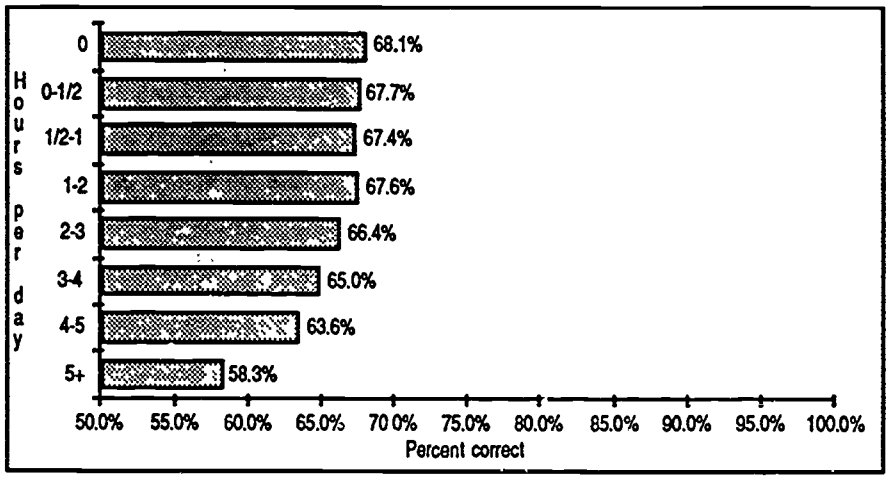


Fig. 3.39

Grade Eight Reading Scores by Time Spent Watching Television

Higher reading scores are associated with lesser amounts of time spent watching television.

Educators as well as parents should be aware that student achievement is associated with the way students use their time outside the school environment.

Conclusion

The nine findings highlighted in this chapter are not to be considered all-inclusive. They were identified by the Reading Assessment and English Language Assessment Advisory Committees to help educators focus on some areas of concern evident from CAP test results in language arts. The nine findings and their corresponding recommendations are summarized below.

Findings	Recommendations
1. At grade six and beyond, students have difficulty following or detecting organizational patterns in text.	Students should practice organization patterns, using a variety of literary genres and instructional strategies in reading and writing instruction.

2. At all grade levels, students have more difficulty with the writing process skills than with supporting skills in written expression.	Students need more practice with the process of writing. Supporting skills instruction should be integrated during the editing phase of composition instruction. Emphasize helping the student present a message clearly to a given audience.
3. At grades six, eight, and twelve, students have more difficulty with higher order reading comprehension than with literal comprehension.	Educators should build on students' background knowledge during discussion, prereading, and prewriting activities to help students learn to make inferences as they read and write.
4. At grades six and eight, students have more difficulty comprehending science passages than literature or social studies passages.	Science should be a greater part of the instructional program at all grade levels from kindergarten through grade eight.
5. At grades three and six, students display mastery of sentence recognition skills, but at grade six and beyond, students have difficulty with sentence combining skills.	Knowledge of sentence limits grows slowly and is best acquired through extensive reading and oral language experience. Oral language activities reinforce the ability to cope with complex sentence structures.
6. Grade three students have difficulty using context to determine word meanings. At grades six and eight, students have difficulty with knowledge of word meanings in literature, science, and social studies. At grade twelve, vocabulary scores continue to decline.	Vocabulary learning must be presented in many different contexts through wide reading and listening activities. Instructional strategies should include a focus on vocabulary building.
7. Students have difficulty selecting the most specific language for a given context.	Students need to learn to write with greater specificity and to judge whether a specific or a general term is needed.
8. Critical comprehension in reading and critical judgments in written expression were identified as areas of weakness.	Students need to use vocabulary and information in many contexts to learn to detect logical contradictions and discover how changes in context change meaning.
9. Higher scores are related to more time reading, more homework, and less time watching television.	

Chapter 4

MATHEMATICS

This chapter describes the results of the 1985-86 administration of mathematics tests in grades three, six, eight, and twelve. These tests were written by California mathematics educators under the direction of the Mathematics Assessment Advisory Committee. Each test measures comprehensively the expectations outlined in the mathematics framework of its time (see Figure 4.1).

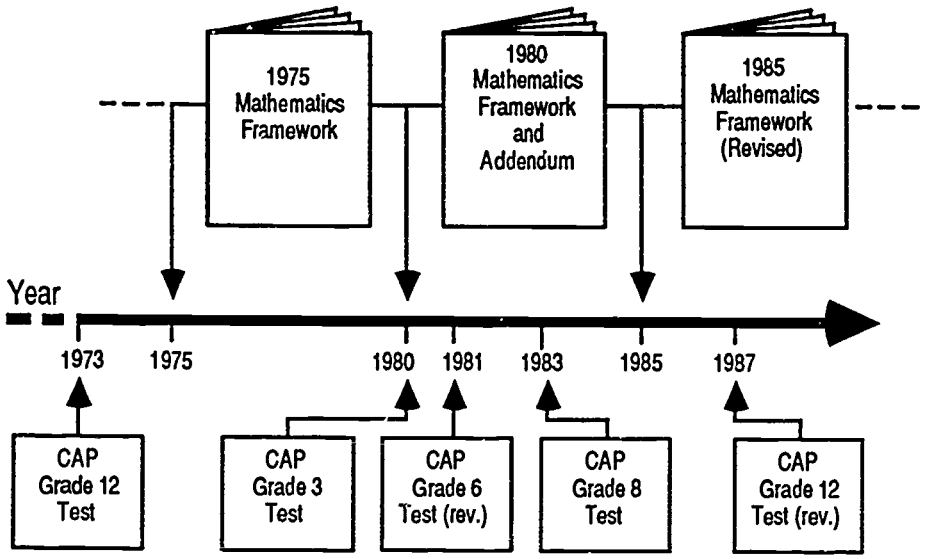


Fig. 4.1

Relationship Between CAP Tests and Mathematics Frameworks

This figure shows the years of framework revisions and the introduction of CAP tests at various grades.

Even though it was in place before the current mathematics framework, the grade eight test, newest of the CAP tests, is aligned most closely with the philosophy and content described in the 1985 framework. The grade twelve test, developed 13 years ago, is currently being revised to bring it in alignment with the 1985 framework and the model curriculum standards. The third and sixth grade tests are aligned with the earlier framework; however, slight revisions will align them much more closely with the new framework.

Findings

The 1985-86 test results were reviewed by the members of the Mathematics Assessment Advisory Committee. The committee's findings are summarized in two ways: first, the trends in overall test scores are shown for grades three, six, eight, and twelve; second, major findings are discussed in light of the skills and concepts emphasized in the 1985 framework. The framework reflects current thinking on the role of computational skills in the age of calculators and computers, particularly highlighting the role of problem solving, estimation, and mental arithmetic. The processes implied serve as a common thread across the strands in mathematics. The committee members, in keeping with the emphasis in the framework, organized their findings under the following areas:

- Problem formulation and analysis
- Problem solution and interpretation
- Spatial reasoning
- Data organization
- Logical reasoning
- Pattern recognition
- Number sense and estimation

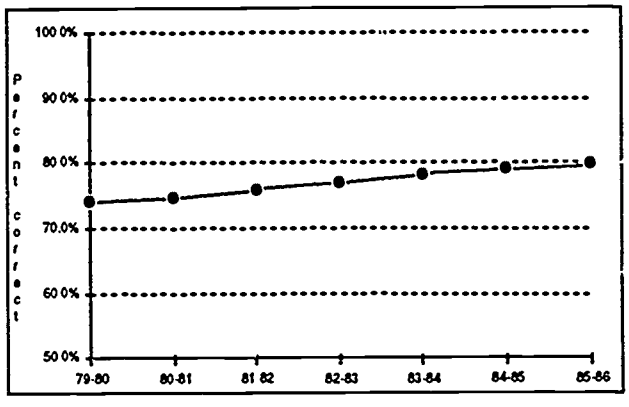
Trends in Overall Test Scores

Mathematics scores increased from 1984-85 to 1985-86 at all grade levels tested. In fact, the overall scores are at the highest level in the history of each test.

Third grade students continued their strong, consistent gain in test scores for the sixth consecutive year (see Figure 4.2).

Fig. 4.2

Grade Three Mathematics Scores, 1979-80 Through 1985-86



Scores improved in all strands from 1984-85 to 1985-86 (see the table of grade three mathematics data in Appendix D), with the greatest gains in problem analysis and models, the least gains in measurement and arithmetic (see Figure 4.3).

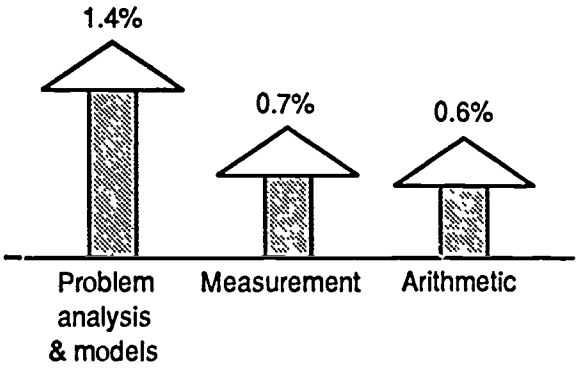


Fig. 4.3

Major Grade Three Score Changes, 1984-85 to 1985-86

Sixth grade students continued their moderate gain in test scores in 1985-86, increasing the overall score to the highest ever (see Figure 4.4).

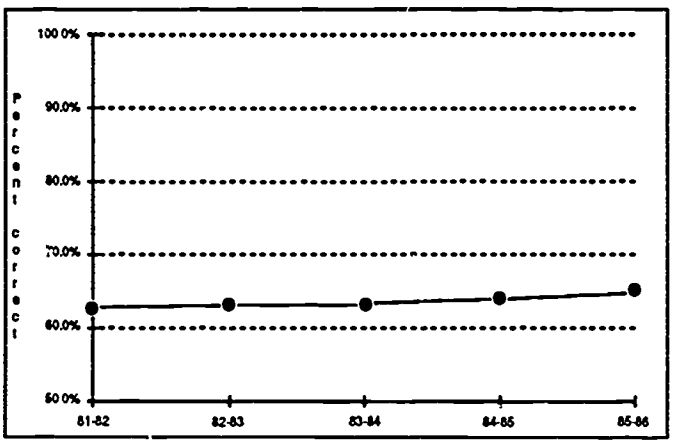


Fig. 4.4

Grade Six Mathematics Scores, 1981-82 Through 1985-86

Scores increased in all strands (see the table of grade six mathematics data in Appendix D) with the greatest long-term gains made in place value and in multiplication and division of decimals (see Figure 4.5).

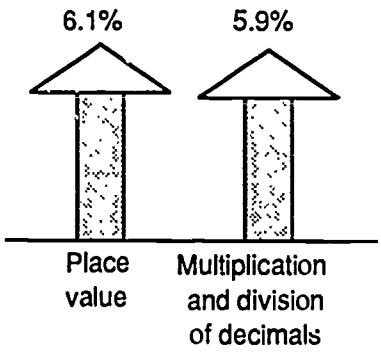


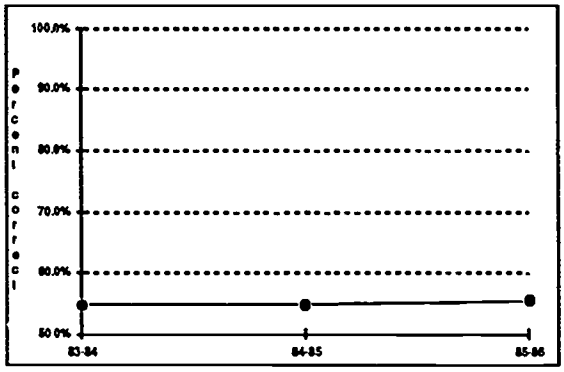
Fig. 4.5

Major Long-Term Gains at Grade Six, 1981-82 Through 1985-86

Eighth grade students' scores increased from 1984-85 to 1985-86 (see Figure 4.6) in all strands except for probability and statistics (see the table of grade eight mathematics data in Appendix D).

Fig. 4.6

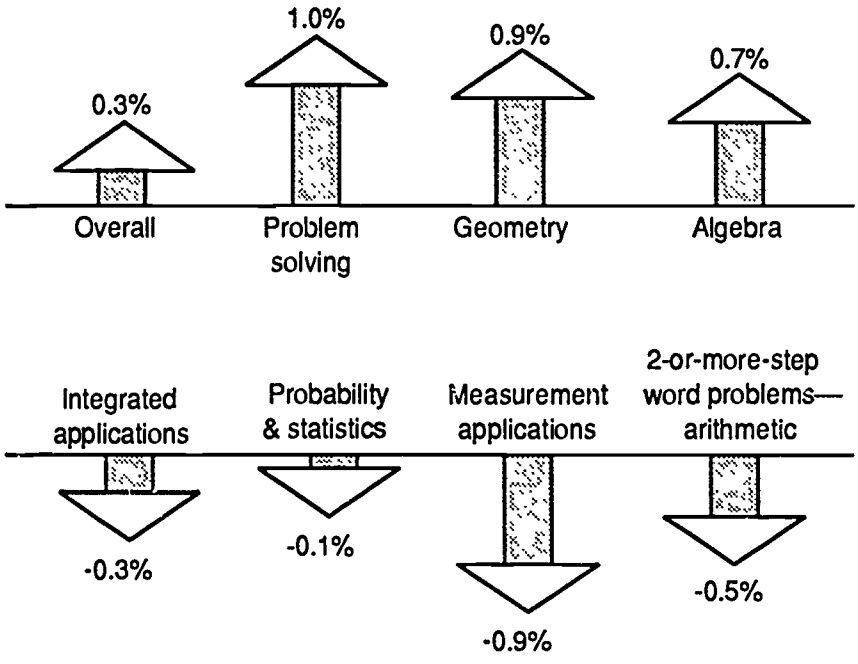
Grade Eight Mathematics Scores, 1983-84 Through 1985-86



During this period, the greatest growth was in problem solving, followed by geometry and algebra. Scores declined slightly in integrated applications, probability and statistics, measurement applications, and two-or-more-step word problems in arithmetic (see Figure 4.7).

Fig. 4.7

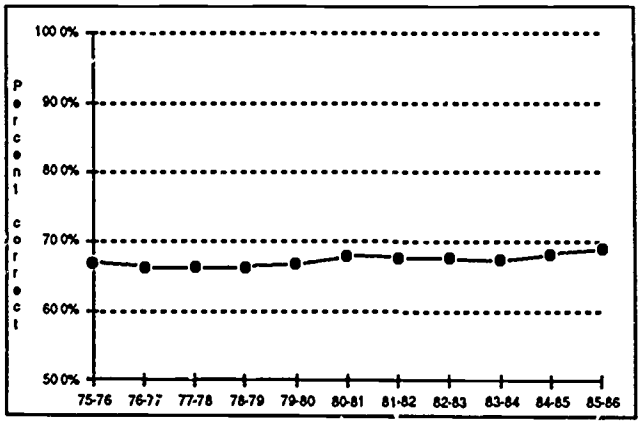
Major Increases and Decreases in Grade Eight Scores, 1983-84 to 1985-86



Twelfth grade students have shown continued gains for the last two years. From 1984-85 to 1985-86, scores increased 0.4 percent (see Figure 4.8).

Fig. 4.8

Grade Twelve Mathematics Scores, 1975-76 Through 1985-86



During this past year the scores increased in all strands except applications in measurement, algebra, and whole number arithmetic (see the table of grade twelve mathematics data in Appendix D). Scores increased particularly in fractions, decimals, and probability and statistics (see Figure 4.9).

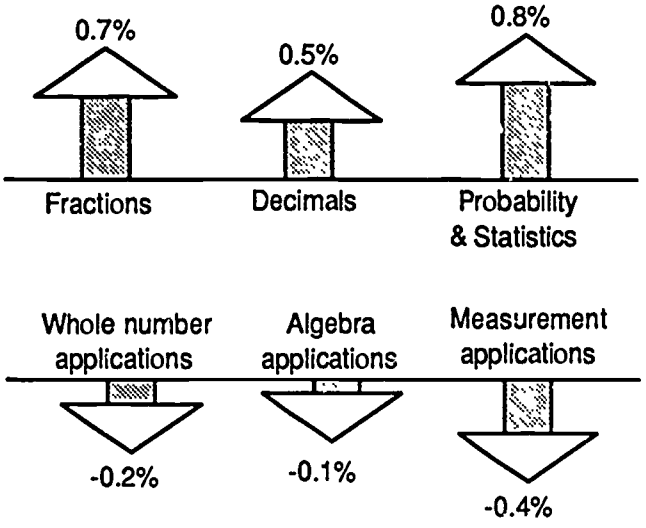


Fig. 4.9

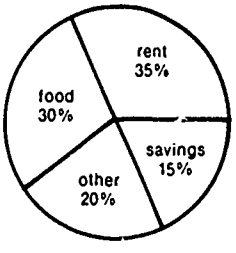
Major Increases and Decreases in Grade Twelve Scores, 1984-85 to 1985-86

Problem Formulation and Analysis

Questions in the category of problem formulation and analysis are intended to assess students' ability to work with complex situations: formulate and model problems, screen relevant from irrelevant information, organize information, make conjectures and test their validity, analyze patterns and relationships, use inductive or deductive processes, identify or evaluate alternative mathematical approaches, find and test solutions, and interpret results. The component of problem solving is thoroughly tested at grades six and eight. Because problem solving questions involve reading (in a mathematical context), only a few items are included at grade three. Items in this category will be included on the new grade twelve test.

Across grades three, six, and eight, students have shown an increase in these skills for the last two years. Sixth grade students performed well on these items with the exception of being able to identify relevant questions that could be answered from information presented graphically (see Figure 4.10).

Which question could be answered using the circle graph?



Jones' Family Budget

Fig. 4.10

Sixth Grade Problem Solving

Sixth grade students generally did well on problem-solving questions. This type, involving the use of information presented graphically, was an exception.

84-85	85-86	
15%	14%	A. How many dollars were spent on rent?
45%	*46%*	B. Did they spend more for food than for rent?
10%	11%	C. How many dollars did they save each month?
30%	29%	D. How many dollars were in the total budget?

Eighth grade students were able to identify relevant mathematical questions from information presented graphically; however, they were less successful when information was presented as diagrams that are less familiar.

An important aspect of analyzing a situation is identifying missing or extraneous information. Students generally have difficulty with such problems. Figure 4.11 is an example of such an item that appeared on the eighth grade test.

Fig. 4.11

Identifying Necessary Information

Many students did not realize that the total amount was not given. The score for eighth graders was lower than that for sixth graders.

Lisa wants to find the cost of a serving of Oatie-Os cereal. What information is not needed?

Gr. 6	Gr. 8	
14%	15%	A. the price of a box of cereal
61%	*59%*	B. the number of calories per serving
10%	9%	C. the number of servings per box
14%	15%	D. the net weight of a box of cereal

Problem Solution and Interpretation

A critical component of problem solving is the verification and interpretation of a solution. The questions in this category require students to review the validity of the model and the accuracy of the mathematical procedures they used.

In the third grade test item in Figure 4.12, students were unable to interpret the question "How many pencils did the class use?" and separate it from the information "This year the class used 56 boxes." The similar question in Figure 4.13 appears on the eighth grade test.

Fig. 4.12

Interpreting Problems

Here, 38 percent of third graders chose 56 instead of 560, showing a lack of skill in making sense of the problem.

There are 10 pencils in each box. This year the class used 56 boxes. How many pencils did the class use?

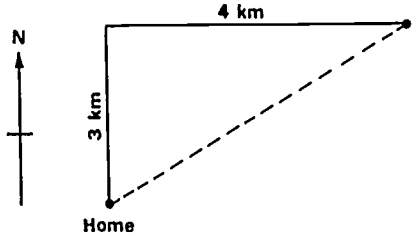
84-85	85-86	
38%	38%	A. 56
18%	19%	B. 506
36%	*38%*	C. 560
6%	5%	D. 5600

Fig. 4.13

Interpreting Problems

Only 30 percent of eighth graders chose 5 km. More chose 7 km, an unreasonable response.

The club members hiked 3 kilometers north and 4 kilometers east, but then went directly home, as shown by the dotted line. How far did they travel to get home?



84-85	85-86	
9%	10%	A. 4 km
31%	*30%*	B. 5 km
19%	20%	C. 6 km
37%	38%	D. 7 km

At grade twelve, the net change in problem solving/applications over eleven test administrations has been a drop of 0.5 percent. The question in Figure 4.14 is typical of the lack of improvement on this skill.

The largest possible square piece is to be cut from a rug that is 9 feet by 12 feet. How many square feet will be in the remaining piece?

84-85	85-86	
40%	39%	A. 3
9%	9%	B. 9
27%	*28%*	C. 27
5%	5%	D. 36
16%	15%	E. None of these

Fig. 4.14

Interpreting Problems

As with other students, twelfth graders often simply use the numbers that appear in a problem, regardless of their appropriateness.

In general, percent correct scores in problem interpretation are lower than in other categories, reflecting the fact that students are prone to direct attention toward getting an answer but neglect to assess the appropriateness or reasonableness of their answers.

Spatial Reasoning Skills

Spatial reasoning is assessed in two ways on the CAP tests. The first is by asking students to match verbal labels to spatial representations of objects, for example, to identify a circle or a square. The second requires students to reason or process spatial information, such as to imagine the result of folding a flat diagram into a three-dimensional object or cutting through a three-dimensional object in order to view it from a particular perspective.

The focus in this analysis is primarily on spatial reasoning tasks, since spatial identification tasks have been widely discussed in previous CAP reports. Spatial reasoning, although probably much more important in classroom instruction, has seldom been mentioned in prior reports.

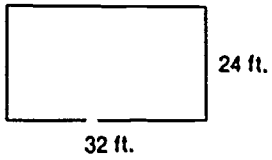
Three critical areas of spatial reasoning cut across all grade levels tested: (1) the influence of using pictures rather than words in problem presentation; (2) the necessity of drawing a picture or forming a mental image to solve certain problems; and (3) the importance of understanding the orientation of objects in space.

In several cases on CAP tests, the same problem is presented completely in words in one item and with graphic representation in another. The advisory committee notes that students perform better on items with visual clues than on those without, especially at the third and sixth grade levels. Students in the third grade are given more pictures; students in grades six, eight, and twelve are expected to draw or mentally visualize their own pictures. In some cases pictures were distracting, particularly for three-dimensional objects, which were interpreted by the students as being two-dimensional objects. Figure 4.15is an example of items in this category.

Fig. 4.15

Interpreting Visual Cues

Students misinterpreted three-dimensional objects as two-dimensional.



Jim and Judy wanted to put a rail fence around their rectangular lot. They wanted the posts to be spaced eight feet apart. How many posts will they need?

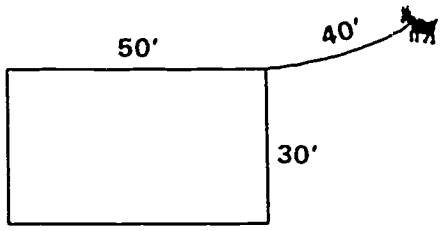
84-85	85-86	
22%	21%	A. 12
41%	*42%*	B. 14
19%	19%	C. 16
17%	17%	D. 18

Problems that include figures occur at all grades but are especially prevalent in the third grade. Similarly, rotations and mental images occur at all grade levels but are most characteristic at sixth grade. Included in this category are problems that ask for simple static images (third grade); ones that require translation, rotation, and reflection of figures (sixth and eighth grades); and folding tasks that involve three dimensions (eighth grade). The committee notes that performance is consistently low on these items (see Figure 4.16).

Fig. 4.16

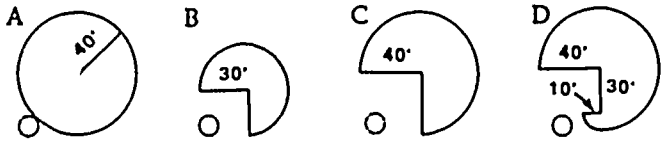
Manipulating Images

Performance of eighth grade students declined on this question.



In the figure above, a goat is tied to the corner of a barn by a 40' tether. Which of the following shows the region in which the goat can walk?

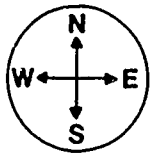
84-85	85-86	
16%	16%	A.
32%	33%	B.
8%	9%	C.
44%	*41%*	D.



The final category is spatial orientation, requiring the most sophisticated spatial reasoning. This category is not tested at the third grade level, and only a few items are included in the sixth grade test. A variety of questions at the eighth grade level involve reading a map, taking a

different perspective, and following directions of increasing difficulty (see Figure 4.17).

If you were facing north and made a 180° turn to the right, what direction would you be facing?



84-85	85-86	
43%	42%	A. East
11%	11%	B. West
6%	6%	C. North
40%	*42%*	D. South

Fig. 4.17

Spatial Orientation

Orientation in space is tested mostly at the eighth grade level.

The committee recommends that more time be spent in classrooms developing spatial visualization and reasoning as a problem-solving strategy.

Organizing and Interpreting Data

Analysis and interpretation of data are assessed on the CAP tests using items that involve reading and interpreting graphs and tables, understanding concepts of probability, identifying and using statistical measures, and selecting appropriate means of representing data.

The mathematics tests include three types of questions on analysis and interpretation of data: (1) reading information from graphs; (2) using information from graphs; and (3) measures of probability and common statistical measures. The first two skills are assessed at all four grade levels. No questions on probability and statistical measures are included at grade three.

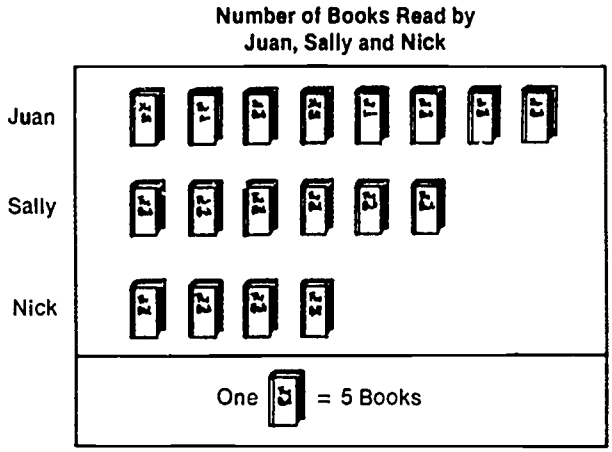
In general, students performed well across all grade levels when asked to read information directly from tables and graphs. (See Figure 4.18.) One exception occurred at the sixth grade level where students misinterpreted the information presented in picture graphs where each symbol represented more than one object.

Fig. 4.18

Reading Graphs

Students do well at reading and interpreting information in the form of simple graphs.

Look at the graph to answer the question.



How many more books did Sally read than Nick?

84-85	85-86	
23%	21%	A. 2
2%	2%	B. 4
5%	5%	C. 6
69%	*72%*	D. 10

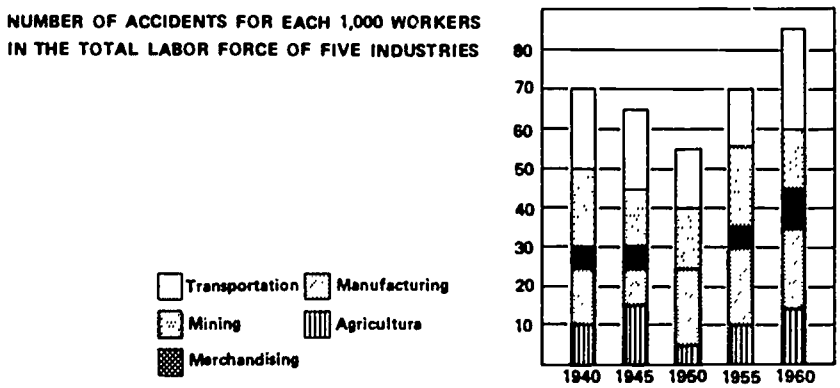
At the eighth grade level, students have increased their scores on reading graphs over the last three years; both the eighth and twelfth grade student scores in this area are satisfactory.

Eighth and twelfth grade students, however, had difficulty using information from graphs to solve problems (see Figure 4.19). Only a few items requiring students to use information read from graphs appear on the sixth and third grade tests. Performance on these items at the sixth grade level was satisfactory, and performance on these items at the third grade level was excellent.

Fig. 4.19

Using Information Graphs

Students at grades eight and twelve have difficulty applying information from graphs to solving problems.



Approximately what percentage of the total number of workers had accidents during 1945?

84-85	85-86	
18%	*18%*	A. 6.5
65%	65%	B. 65
2%	2%	C. 75
14%	14%	D. Cannot be determined

Questions involving probability occur at three grade levels. At the sixth grade students were not very successful with items involving concepts of probability. At the eighth grade, scores on items involving probability have declined over the past three years. In fact, eighth grade students scored significantly lower on items involving probability of "events that are certain to occur" or "are certain not to occur" than students at the sixth grade level, indicating that very little instruction takes place in this skill (see Figure 4.20). Twelfth grade students appear to have an intuitive understanding of probability and the concepts of equally likely events or "what is probable," but they do not fare well on items involving expectation or the "use" of probability to make inferences.

For four games you have the following chances of gaining points:

Game A: 10 percent chance of gaining 20 points
Game B: 20 percent chance of gaining 15 points
Game C: 40 percent chance of gaining 10 points
Game D: 50 percent chance of gaining 5 points

In the long run, you would be most likely to gain the GREATEST number of points in:

84-85	85-86	
18%	17%	A. Game A
10%	10%	B. Game B
37%	*38%*	C. Game C
35%	34%	D. Game D

Fig. 4.20

Probability

Probability is not well understood by many students.

The achievement of students in computing and understanding "average" seems to relate to students' maturation. In general, twelfth grade students were able to calculate successfully an average of a given set of data. Sixth and eighth grade students were not as successful in computing an average. Though they understood "average" itself, twelfth grade students were not as successful in using the average of a set of data to find new information as were sixth and eighth grade students.

The committee notes that the overall performance in this area was still unsatisfactory, given the increasing importance and widespread use of these ideas in daily life.

Logical Reasoning

The ability to reason logically is both a prerequisite to learning mathematics and a desired outcome of mathematical instruction. Mathematics provides an excellent context in which to make students aware of the logical structures they need to function successfully in any setting.

Many of the questions included on the test require an understanding of such words as *not, and, or, all, some, none,* or *if . . . then.* More than half the questions require two or more steps for solution. Some questions also require students to reason deductively and make inferences. The following table summarizes the number of questions on logical reasoning and how well students performed on those questions.

Grade level	Total items	Number of items with scores: 0-50%	51-66%	67-100%
3	34	0	6	28
6	66	14	25	27
8	125	35	43	47
12	44	17	14	13

Many of the questions on which the performance of students was less than adequate require understanding negations, or the meaning of "not" (see Figure 4.21).

Fig. 4.21

Understanding Negation

This is a typical third grade item requiring simple arithmetic and negation.

There were 12 crayons. 1/3 were red. How many were not red?

84-85	85-86	
30%	30%	A. 4
10%	9%	B. 6
30%	*31%*	C. 8
29%	29%	D. 9

The question in Figure 4.22 from the eighth grade .est requires knowledge of the definitions of standard geometric figures and the ability to use the logical qualifiers and negation correctly.

Fig. 4.22

Using Logical Qualifiers and Negation

The score here is well below that for just random guessing.

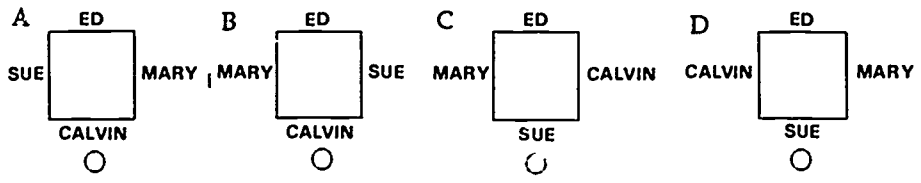
Which of the following is not true?

84-85	85-86	
17%	17%	A. All squares are rectangles.
18%	*18%*	B. All rectangles are squares.
30%	29%	C. All squares are parallelograms.
34%	34%	D. All parallelograms are quadrilaterals.

Figure 4.23 shows that students at grade eight were relatively more successful in chaining together a series of simple inferences.

Fig. 4.23

Chaining Simple Inferences



Four people are sitting around a table. Mary is sitting on Ed's right. Calvin is across from Ed. Which table (seen from above) is the one described?

84-85	85-86	
32%	29%	A.
61%	*62%*	B.
3%	4%	C.
3%	3%	D.

Another frequent shortcoming is the inability to make correct statistical inferences. Figure 4.24 is an example of this kind of problem.

On opening night a total of 2,000 cars entered a drive-in movie theater, but the manager kept track of only 1,000 cars. For these 1,000 cars the average number of persons per car was 2.7. The manager wants to estimate the average number of passengers per car for the entire 2,000 cars. Which of the following statements is the most sensible?

84-85	85-86	
5%	5%	A. The best estimate for all 2,000 cars is half of 2.7.
46%	45%	B. The best estimate is twice 2.7.
27%	*29%*	C. The best estimate is 2.7.
11%	10%	D. The best estimate is 3.
10%	9%	E. No estimate is reasonable.

Fig. 4.24

Making Statistical Inferences

The results on this question from the twelfth grade test shows students' weakness in reasoning skill.

The results show a general lack of reasoning skills at all grade levels, particularly at grades six, eight, and twelve.

Pattern Recognition

The 1985 mathematics framework states that "mathematics power, which involves the ability to discern mathematical relationships, reason logically, and use mathematical techniques effectively, must be the context in which skills are developed." The discovery of *patterns* is essential to the development of mathematical power and is commonly used as a problem-solving strategy.

Pattern recognition on CAP tests comprises three types of questions:

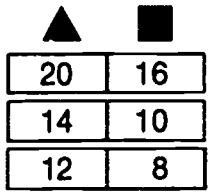
- *Sequencing* questions include counting sequentially and using concrete objects (grade three), sequencing of whole numbers (grade six), and symbolically representing functions (grade six and beyond).
- *Analyzing relationships* items include descriptions (grade three), proposing rules for relationships (grades three and six), determining rules through the use of variables (grades six and eight), and investigating functions and inverse functions (grades eight and twelve). The analysis of the relationships of symmetry, congruence, similarity, and transformations is also included in this category.
- *Representation on coordinate grids* includes locating points on coordinate planes (grade six), finding relations of functions (grades six and eight), and recognizing nonlinear inverse functions (grade twelve).

The committee noted that as students encountered more sophisticated patterns, the level of recognition declined. For example, at grade three, 77 percent of the students were able to correctly complete the pattern 1, 4, 7, ___ , 13, but only 48 percent were able to provide the correct written description of a similar numerical pattern (see Figure 4.25).

Fig. 4.25

Simple Numerical Patterns

Describing a pattern is more difficult than completing a patterned sequence for third graders.



In the table above, the rule is:

84-85	85-86	
20%	21%	A. Add 2
10%	9%	B. Subtract 2
48%	*48%*	C. Subtract 4
21%	21%	D. Multiply by 4

At grade six students were successful (86 percent) in analyzing relationships based on addition of a constant but were unsuccessful with a relationship based on multiplication (49 percent). Although students showed a significant improvement from grade six to grade eight (68 percent) on the latter type of item, the level of achievement, in the opinion of the committee, was unsatisfactory.

Grade three students were successful in locating points on a coordinate grid (89 percent). However, there was a significant decline in this skill at grade six (57 percent), and the decline continued at grade eight.

Number Sense and Estimation

An understanding of numbers and their properties promotes facility with numbers or "number sense" which enables students to make reasonable judgments in practical situations. Even if a problem involves the use of a calculator or similar technological tool, students must have well-developed number sense to evaluate solutions.

The questions on number sense and estimation assess such abilities as judging the reasonableness of a calculation; understanding concepts such as place value and order relationships; applying number properties rather than memorizing them; seeing the connections between factors, divisors, multiples, and prime numbers; and visualizing and estimating physical measurements.

At grade six students had difficulty judging whether their answers were sensible (see Figure 4.26). Students are perhaps using rote algorithms to solve this kind of question rather than applying understanding of place value.

Fig. 4.26

Judging the Reasonableness of a Solution

A majority of student missed this question, in which students are intended to see that 9.78 is approximately 10 and a sensible answer is close to 5.

9.78 - 5 =

84-85	85-86		
29%	*30%*	A.	4.78
3%	2%	B.	9.23
67%	66%	C.	9.73
1%	1%	D.	9.83

The questions in figures 4.27 and 4.28 appear on both the sixth and eighth grade tests. They are designed to assess students' understanding

of divisor, dividend, and remainder in a long-division operation and estimating. The actual long-division algorithm has been performed for students. Only 41 percent of students at grade six and 58 percent of students at eighth grade answered the question successfully. The committee concluded that students lack a connection between numbers derived from arithmetic algorithms and their use in solving practical problems.

The 130 students from Marie Curie School are going on a picnic. Each school bus holds 50 passengers. How many buses will they need?

Rose did the following:

$$\begin{array}{r} 2 \\ 50\overline{)130} \\ \underline{100} \\ 30 \end{array}$$

Rose's arithmetic is correct. How many buses will be needed?

Gr. 6	Gr. 8	
6%	8%	A. 2
43%	19%	B. 2 R30
10%	12%	C. 2 3/5
41%	*58%*	D. 3

Fig. 4.27

Applying Arithmetic Algorithms

A large number of sixth and eighth grade students cannot interpret *divisor*, *dividend*, and *remainder*.

50 is divided by a number between 1 and 2. The answer would be a number between

Gr. 6	Gr. 8	
15%	17%	A. 1/50 and 1/25
7%	10%	B. 0.5 and 1
24%	22%	C. 1 and 25
42%	*41%*	D. 25 and 50
10%	9%	E. 50 and 100

Fig. 4.28

Estimating

A no growth in performance from sixth to eighth grade on this type of item indicates a lack of teaching of estimation skills.

The question in Figure 4.29 is also designed to assess estimation skills, but at the level and sophistication of students at the twelfth grade. A student should be able to see that \$1.06 is approximately \$1, and \$1.48 is approximately \$1.50. Dividing 10 by 1 and 1.5 gives a range from approximately 7 to 10. Inadequate performance on this question indicates that estimation and number sense skills need to be emphasized throughout the kindergarten through grade twelve mathematics curriculum.

In a certain city the price of gasoline has varied between \$1.06 and \$1.48 per gallon during the past year. During that period, which of the following purchases could have been made with a \$10 bill without receiving any change back?

85-86	
5%	A. 5.1 gallons
18%	B. 5.8 gallons
59%	C. 8.7 gallons
11%	D. 10.2 gallons
4%	E. 12.7 gallons

Fig. 4.29

Estimating (Grade Twelve)

Only 59 percent of twelfth grade students answered this question correctly.

Students perform relatively better on items involving physical situations, or situations requiring measurement, than in other areas of estimation (see Figure 4.30).

Fig. 4.30

Estimating Measurements

If students had more experiences with physical measurements, they would grasp measurement estimation better than is shown on this sixth grade item.

Which object would be about 12 feet long?

84-85	85-86	
12%	11%	A. a bicycle
73%	74%	B. an automobile
5%	5%	C. a shoe
9%	9%	D. a baseball bat

An understanding of divisibility and prime factorization is essential for improving number sense. On the question in Figure 4.31, 22 percent of eighth grade students made a decision that 2 x 15 is divisible by 4, even though identification of the prime factors of this problem—2, 3, and 5—makes that impossible.

Fig. 4.31

Understanding Divisibility

Number sense builds on an understanding of divisibility and prime factorization.

Which is divisible by 4 and 5?

84-85	85-86	
21%	22%	A. 2x15
6%	7%	B. 3x6
12%	12%	C. 9x5
59%	57%	D. 10x10

Findings and Recommendations

The following is a summary of the main findings. Recommendations of committee members to improve instruction accompany each major finding.

Findings	Recommendations
1. Problem solving continues to be a general area of weakness at all grade levels tested. Students showed weakness particularly related to analyzing a problem to find missing or extraneous information. They also lacked a sense of the reasonableness of their solutions to problems.	Classroom instruction should use both routine and nonroutine situations and allow students to engage in oral interaction by stating and restating questions, then using various strategies to solve the problem. Students should be led to see for themselves whether their answers are reasonable in light of the question asked.
2. In computational questions students tend to use rote algorithms without thinking about	Instruction should provide opportunities for students to develop their understanding of numbers

the numbers invc'ved or operations performed. They lack a sense about numbers and results of operations. Their lack of number sense reflects a general weakness in their knowledge of place value, estimation, rounding, and factoring.	and operations by using manipulatives. Teachers should emphasize helping students understand the relationship between, for example, subtraction and division; divisor, dividend, and remainder in a division algorithm; percent, decimals, and fractions.
3. Although many of the CAP application problems in arithmetic, geometry, patterns and functions, and probability are in a "daily life" context, students use algorithms without grasping the context. The failure to grasp the situation results in improperly setting up the problem.	Instructional programs should develop thinking skills, preferably using classroom discussion. Emphasis should be placed on developing relationships between formal algorithmic skills and their application to real situations.
4. Students generally show weakness with concepts in geometry and measurement. They show particular weakness with spatial reasoning.	Manipulatives, actual measurements, and informal explorations should be used to promote understanding of geometric and measurement concepts.
5. From the more specific findings, one can extrapolate that students do not have a sense of mathematical "elegance," which is a reflection of both an intuitive number sense and a strong computational ability. This combination seems not to be engendered in students.	Classroom tests should emphasize not only the correct solution but also students' explanations of their chosen procedures. Some of the concepts and skills (such as formulating a problem and using the most efficient method to solve a problem or perform computations) should be assessed by methods that emphasize understanding rather than rote memorization.

Chapter 5

HISTORY-SOCIAL SCIENCE

85 86

This chapter describes the results of the second administration (spring 1986) of the history-social science portion of the *Survey of Academic Skills: Grade 8*. History-social science includes four major areas (United States history, citizenship/government, world history/cultures, and geography/economics). Critical thinking skills and a basic skills assessment are infused into the four major areas, as illustrated in Figure 5.1. A detailed description of the test can be found in the *History-Social Science: Grade 8—Rationale and Content*.

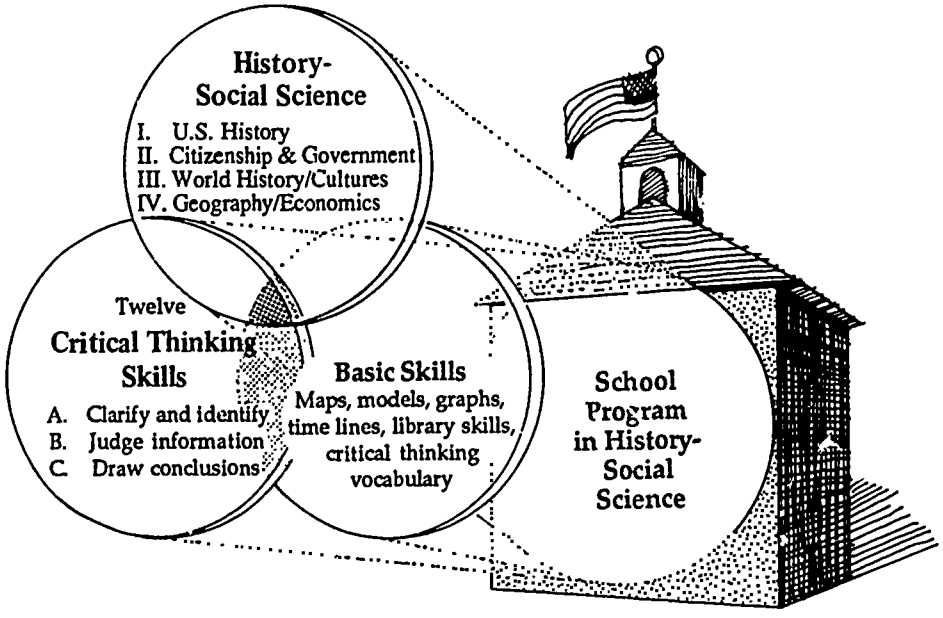


Fig. 5.1

Infusion of Critical Thinking Skills and Basic Skills into the History-Social Science Assessment

Critical thinking skills and basic skills are included in the four major areas of history-social science. Scores for United States history, citizenship/government, world history/cultures, and geography/economics items that involve the use of critical thinking and basic skills are reaggregated to produce scores in the critical thinking and basic skills reporting categories.

The information in this chapter was produced by a special panel of the History-Social Science Assessment Advisory Committee (see

Appendix E for a list of members) following a review of the 720 items that constitute the test and their associated item statistics.

History-social science results are presented in terms of scaled scores because (1) school and district reports are presented in terms of scaled scores; (2) results can be compared over years, independent of test changes; (3) history-social science scores can be compared with scores in other content areas; (4) grade eight scores can be compared to history-social science results at other grade levels when tests are implemented at grades three, six, ten, and twelve; and (5) year-to-year changes are more comparable in scaled scores than in percent correct scores. As in the first year of all CAP tests, the 1984-85 statewide scores for history-social science were assigned the anchor value of 250. The results for illustrative test items are presented in terms of the percent of students selecting each response. The value for the correct answer is in italic type.

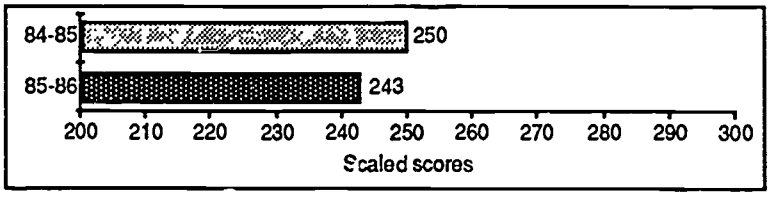
Findings and recommendations associated with each assessment area within the history-social science test are summarized and discussed in turn:

- United States history
- Citizenship/government
- World history/cultures
- Geography/economics
- Basic skills
- Critical thinking skills

The scores for each assessment area and the reporting categories that make up the area are presented graphically. Each section contains a brief statement of the findings of the special panel, items that illustrate the findings, and the panel's recommendations. The complete history-social science data are contained in Appendix E.

Fig. 5.2

History-Social Science Statewide Results, 1984-85 and 1985-86



The statewide scaled score for history-social science dropped seven score points as compared to the 1984-85 anchor value of 250 (see Figure 5.2). Although scores in all major areas (see Figure 5.3) declined in 1985-86, student performance on items related to citizenship and government showed the greatest decline. Scores on items relating to basic skills showed the least decline.

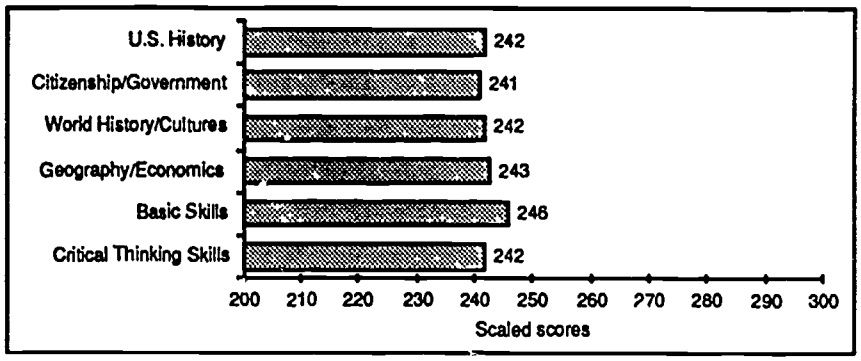


Fig. 5.3

Results for Major Areas in History-Social Science, 1985-86

All scores for 1984-85 were set at the anchor value of 250.

Findings and Recommendations

The special panel is concerned that many students have not internalized the common core of history-social science knowledge to the point that they can deal successfully with many test questions, especially those that require an understanding of concepts, principles, and ideals. Students also had difficulty with items requiring an understanding of the links between historic events and the present. Students who are unaware of critical connections will not be able to make reasoned decisions on contemporary issues, and their ability to participate effectively in a democracy will be limited.

United States History

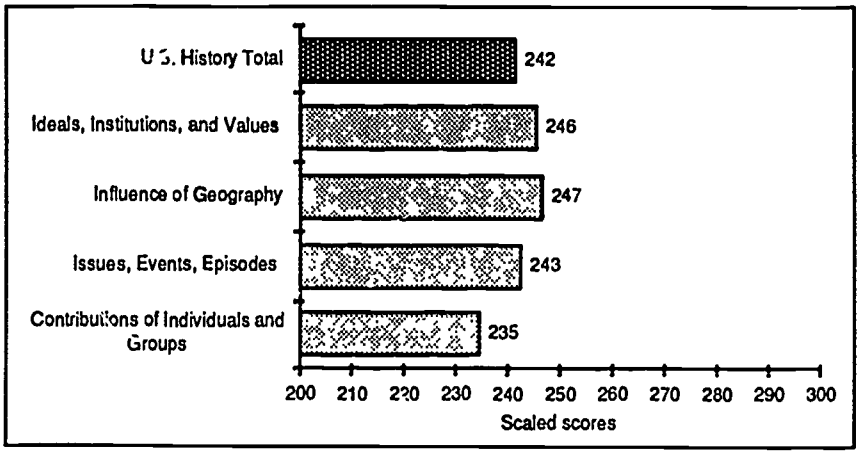


Fig. 5.4

Scores for the United States History Category, 1985-86

In the United States history area, students were tested on their knowledge of our nation's ideals, institutions, and values; the influence of geography on history; the sequence of important events; and the significant contributions of men, women, and diverse groups to the political, economic, social, and cultural development of the United States. The panel of specialists is concerned that scores in all areas of United States history declined in 1985-86 from the 1984-85 baseline value of 250 (see Figure 5.4). The panel was especially concerned that students continued to have difficulty with items addressing ideals and

values as reflected in historic documents, critical issues, and events (see Figure 5.5) and especially the contributions of individuals and groups to the American heritage (see Figure 5.6).

Fig.5.5

Ideals and Values

The results on this item illustrate students' lack of understanding of American ideals and values.

Which of the following quotations BEST describes the kind of government established by the United States Constitution?

84-85	85-86	
21%	17%	A. "Millions for defense, not one cent for tribute."
20%	22%	B. "Walk softly and carry a big stick."
11%	13%	C. "The buck stops here."
47%	*45%*	D. "A government of laws, not of men."

Fig. 5.6

Contributions of Individuals

Performance on such items as this suggests the extent of student difficulty with items related to the contributions of significant individuals.

George Washington had a significant influence on the Presidency of the United States mainly because he

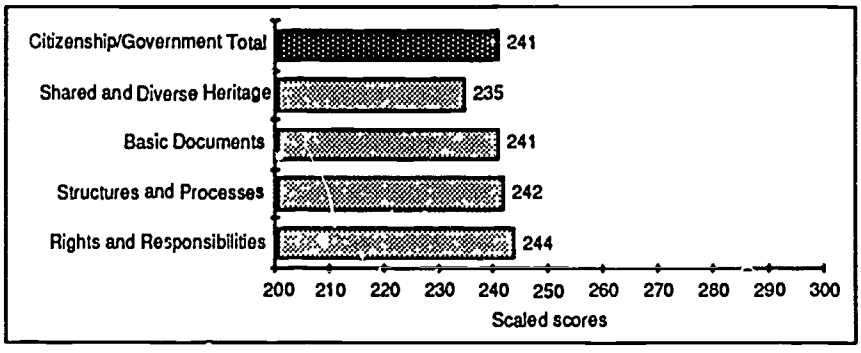
84-85	85-86	
35%	36%	A. was an outstanding general.
33%	*30%*	B. established precedents (laid the groundwork) for future presidents.
27%	27%	C. signed a treaty that ended the War of American Independence.
5%	5%	D. was close friends with other important American leaders, such as Thomas Jefferson and Patrick Henry.

Recommendations: Students must have opportunities to internalize knowledge of United States history that encourages a depth of understanding beyond the superficial level. Students should be required to establish relationships between historic events and contributions to life in modern America. Historic documents and events should be explained in terms of how they affect the lives of students today.

Citizenship/Government

Fig. 5.7

Scores for the Citizenship/Government Category, 1985-86



As shown in Figure 5.7, scores in all areas of the citizenship and government portion of the history-social science test declined in 1985-86. Constitutional principles and the protection afforded all members of our society are assessed in this portion of the test. Test items address knowledge of rights and responsibilities of our citizens based on the United States Constitution, Declaration of Independence, and other

basic documents. Knowledge of the structure of government, political systems, judicial proceedings, and noteworthy historical figures are also included. Scores on items on our shared and diverse heritage showed the greatest decrease (see Figure 5.8). The panel is very concerned with student performance on items related to the structure and processes of American government (see Figure 5.9) and items related to individual rights and responsibilities.

Minority opinions are important in our democratic society because

84-85	85-86	
51%	*48%*	A. it is the right of any and all people to be heard under our laws.
10%	12%	B. the majority does not have the power to carry out its opinions.
18%	19%	C. minority opinions appeal to most of the people.
19%	18%	D. the majority must have support from all the people.

Fig. 5.8

Shared and Diverse Heritage

Students had difficulty with questions on concepts of shared and diverse heritage.

Congress can override a President's veto by

84-85	85-86	
7%	7%	A. waiting ten days after the session ends.
51%	*49%*	B. a two-thirds vote in both houses of Congress.
11%	14%	C. appealing to the Supreme Court.
30%	28%	D. a majority vote in both houses of Congress.

Fig. 5.9

Governmental Processes

Students had difficulty dealing with questions on governmental processes.

Recommendations: To help students appreciate their rich American heritage, teachers should emphasize the contributions of individuals and groups to our diverse culture. To understand government structure and processes, students must be given opportunities to role play key government functions through simulations, such as mock trials, moot courts, and constitutional conventions. Students can be provided with opportunities to appreciate their rights and responsibilities through study of current events and examination of controversial issues.

World History/Cultures

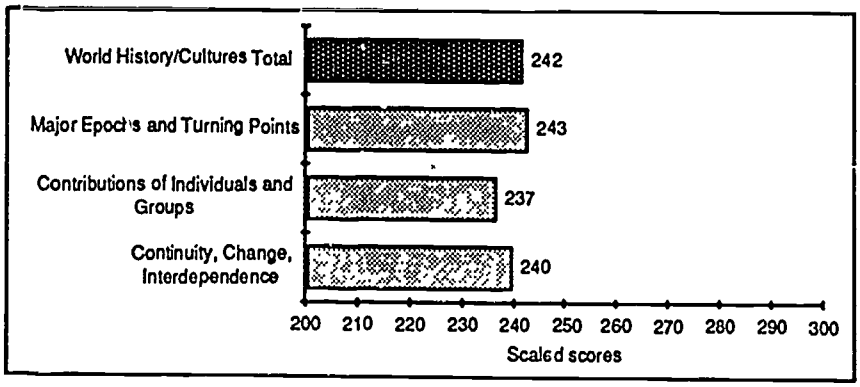


Fig. 5.10

Scores for the World History/ Cultures Category, 1985-86

In the world history/cultures section of the test, students were asked to demonstrate their knowledge of the major epochs, eras, events, and turning points that have shaped human societies. Students responded

to items on the historical and cultural contributions of individuals and groups, the relationship of the past to the present, the reality of global interdependence, and the nature and implications of change (see Figure 5.10). The panel concluded that many students have a narrow or egocentric view of the world. Many students did poorly on items on major turning points in world history (see Figure 5.11). Students displayed little understanding of the role played in history by significant individuals (see Figure 5.12). As was also evident from the United States history portion of the test, students appear unable to link historic events to the present.

Fig. 5.11

Major Turning Points

Students have a weak understanding of the significance of major developments in the history of the world.

During the Renaissance, the two activities that expanded and contributed to the growth in power and wealth of states and nations were

84-85	85-86	
28%	28%	A. art and music.
20%	20%	B. science and medicine.
21%	23%	C. literature and architecture.
29%	*26%*	D. trade and banking.

Fig. 5.12

Significant Individuals

Students had difficulty with items related to significant figures in world history.

Charles Dickens, William Shakespeare, and Geoffrey Chaucer were

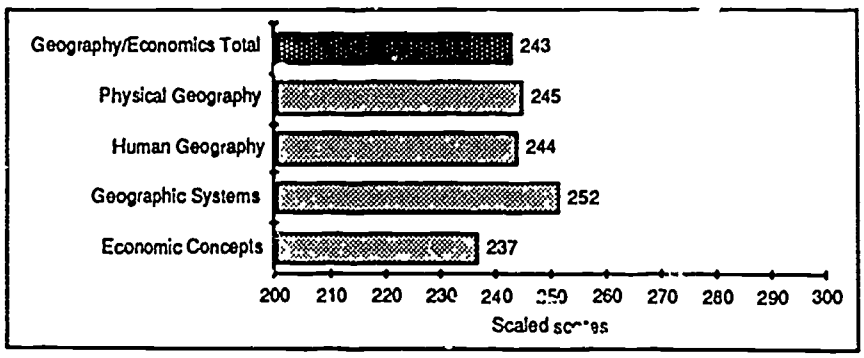
84-85	85-86	
27%	29%	A. French authors.
45%	*43%*	B. British authors.
24%	23%	C. American authors.
3%	3%	D. Russian authors.

Recommendations: To help students understand major turning points in world history, teachers should encourage them to construct time lines, charts, and graphs that depict historic events and their impact on subsequent developments. World literature and films can be used to make history come alive. The study of literature and history should be a joint venture to help students become aware of the contributions of significant individuals and the times in which they lived. To better understand change, students must comprehend such concepts as *decline, progress,* and *diffusion* reinforced by specific examples. Suitable topics might include changes in communication (printing press to computer), political organizations (tribe to nation-state), transportation (wheel to rocket), and new concerns for environmental management.

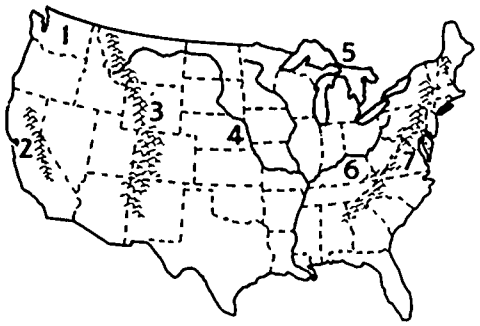
Geography/Economics

Fig. 5.13

Scores for the Geography/Economics Category, 1985-86



Geography items were designed to evaluate student knowledge of the dynamics of the earth's atmosphere, weather and climate, erosion and landform-building processes, flora and fauna, and the natural environment (see Figure 5.13). Students continue to display an uneven grasp of the basic concepts of both physical and human geography. This is exemplified by the fact that 42 percent of the students were not able to locate the Great Plains on a map of the United States (see Figure 5.14). A clear understanding of the world, its place, and geographic relationships continues to elude many students. Students, however, improved in the area of geographic systems, which requires a synthesis of physical and human geographic concepts (see Figure 5.15).



Which number on the map shows the location of the Great Plains?

84-85	85-86	
58%	*57%*	A. 4
10%	10%	B. 5
7%	8%	C. 6
24%	24%	D. 7

Fig. 5.14

Geographical Locations

Test questions requiring knowledge of physical geography were difficult for students.

The earth is a system. People, animals, plants, soil, minerals, water, and air are all parts of the system. All parts must function in a certain way for the system to operate properly. These statements suggest that

84-85	85-86	
6%	6%	A. it is easy to keep the system functioning.
25%	24%	B. the parts of the system are independent of each other.
10%	8%	C. the earth is interesting to study.
58%	*61%*	D. whatever happens to any part of the system affects the other parts.

Fig. 5.15

Geographic Systems

Student performance improved on items related to geographic systems.

Economics items cover how people use resources to satisfy needs and wants. Many students experienced difficulty with basic economics concepts, such as how people use their limited resources to satisfy their needs and wants over time (see Figure 5.16). Students especially had difficulty with concepts and terms related to economic resources, systems, opportunity costs, specialization, money, markets/price systems, command systems, and interdependence.

You read the following headline: "Coffee Growers Form Monopoly." How will the new coffee monopoly most likely differ from a highly competitive coffee growing industry?

Fig. 5.16

Basic Economic Concepts

This item illustrates student difficulty with basic concepts in economics.

84-85	85-86	
27%	29%	A. The price of coffee will decline significantly.
24%	23%	B. The coffee growers will increase their use of capital goods.
32%	32%	C. The coffee growers will increase output and hire more workers.
15%	*14%*	D. There will be less reason for the coffee growers to be efficient.

Recommendations: The panel recommends that economic concepts and terms be integrated into the history-social science curriculum from kindergarten through grade twelve. Students should have opportunities to apply basic economic concepts to their daily lives. This can be accomplished at the beginning with an analysis of student needs and wants and allocation of resources. Activities such as personal bank accounts, simulation of bank operations, stock market analysis, hypothetical purchase of stock, and market analysis can be helpful.

Basic Skills

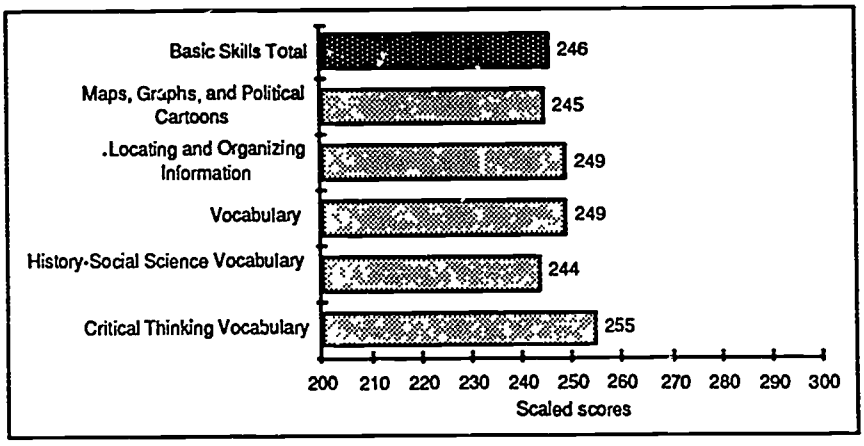
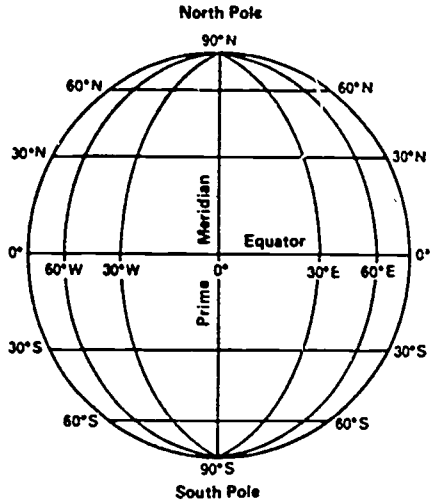


Fig. 5.17

Scores for the Basic Skills Category, 1985-86

Basic skills in the social sciences are the skills that students must have to acquire knowledge from the social sciences and from history as presented in all media. In this section, students are asked to interpret maps, charts, graphs, time lines, and other symbolic materials; to locate, select, and organize information, using appropriate reference materials; and to demonstrate understanding of vocabulary appropriate to history-social science.

There was a slight statewide decline in scores for basic skills this year (see Figure 5.17). The skill of locating and organizing information declined by only one scaled score point. The panel is, however, very concerned about the drop in statewide scores for items relating to maps, graphs, and political cartoons (see Figure 5.18). The panel was especially concerned about student performance on test items related to longitude and latitude; map projections (such as polar projections); location, both specific and relative, including such concepts as place, space, region, and pattern; and time lines/ chronology. Students appeared to have difficulty across the test with history-social science vocabulary; however, the panel was pleased that the statewide score for critical thinking vocabulary increased five scaled score points in 1985-86 (see Figure 5.19).



Lines of longitude are drawn

84-85	85-86	
22%	22%	A. east and west.
61%	*58%*	B. north and south.
14%	15%	C. parallel with the equator.
2%	2%	D. along major transportation routes.

Fig. 5.18

Map Skills

This item illustrates student difficulty with basic map skills.

Choose the BEST definition for the underlined word.

The students in Mary's social studies class could not understand why the latest unemployment statistics were so high. Mary offered to make an inference based on all of the information about unemployment that the class had. This means that Mary will

84-85	85-86	
5%	5%	A. criticize the statistics.
40%	37%	B. verify the events and trends that led to the rise in unemployment.
49%	*50%*	C. offer a conclusion based on the available information.
6%	5%	D. write down a set of questions for the teacher to answer.

Fig. 5.19

Critical Thinking Vocabulary

Student performance on critical thinking vocabulary items improved in 1985-86.

Recommendations: The panel recommends that students have more opportunities to make maps that reinforce an understanding of the concepts of longitude and latitude, regions, location of major cities, countries, continents, and bodies of water. Students should be required to make charts and graphs to compare similarities and differences and draw conclusions on history-social science information.

Students should also be asked to write short essays comparing two countries, using political, physical, and specialty maps. Students should also be expected to make and use time lines. Students need continuous review and reinforcement of history-social science vocabulary. New terms should be clustered and connected to the students' prior knowledge to make meaningful connections.

Students must be given opportunities to write papers about subjects that they want to investigate so that they can use sources beyond the encyclopedia; that is, students should be expected to produce more "I-search" papers that require the use of primary sources.

Critical Thinking Skills

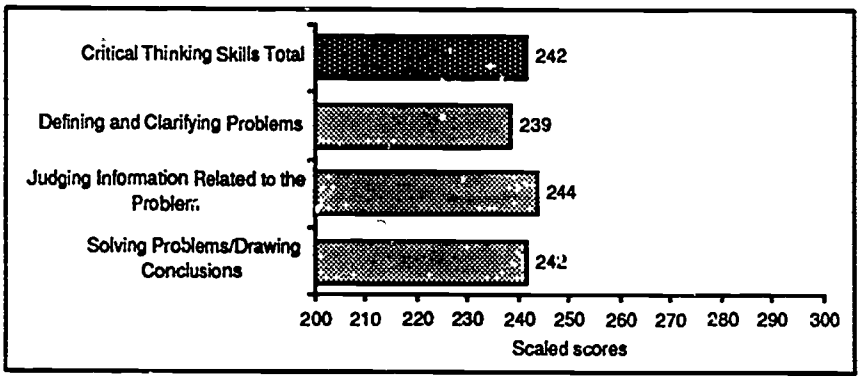
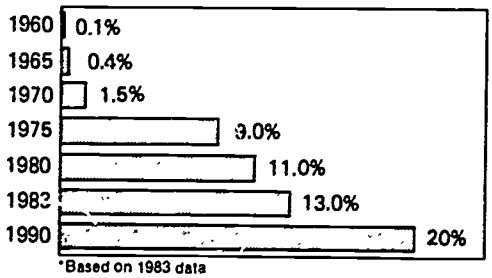


Fig. 5.20

Scores for the Critical Thinking Skills Category, 1985-86

The critical thinking skills require that students define and clarify, make judgments, and draw conclusions. The items consist of questions about subjects covered in United States history, citizenship/government, world history/cultures, and geography/economics. The special panel was deeply concerned that scores for all of the critical thinking skills decreased in 1985-86 (see Figure 5.20). The largest drops were observed in the skills related to identification of relevant information and probable consequences and causality (see figures 5.21 and 5.22). The only bright spot on a rather dark canvas was that the statewide score for critical thinking vocabulary increased, as was described in the previous section.

United States Electricity Produced from Nuclear Power*



*Based on 1983 data

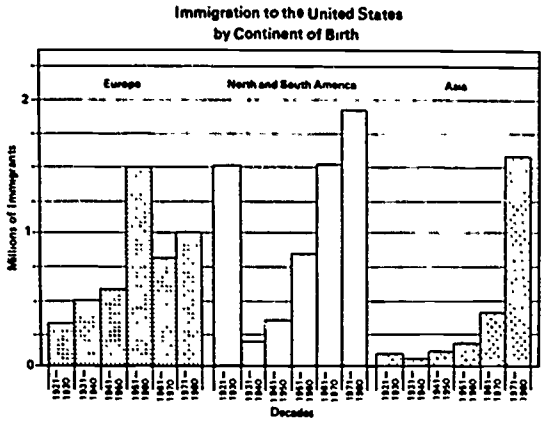
Which of the following statements can be verified from the information in the above chart?

84-85	85-86	
8%	8%	A. The United States is relying less and less on nuclear power for electrical needs.
16%	16%	B. The amount of electricity provided by nuclear power has generally remained the same over the years.
33%	31%	C. The southern and western states provide most of the electricity generated by nuclear power plants.
42%	*40%*	D. In 1990, most electricity will be provided by non-nuclear power sources.

Fig. 5.21

Relevant Information

Students experienced difficulty with test items dealing with relevant information.



Using the chart above, what sentence below BEST tells you what is likely to happen between the years 1981 and 1990 if recent trends continue?

84-85	85-86	
6%	6%	A. Immigration from Europe will continue to decline.
12%	11%	B. Immigration from Asia will decline.
31%	*27%*	C. Immigration from all of these continents will rise above current levels.
51%	55%	D. Immigration from all of these continents will decrease.

Fig. 5.22

Predicting Consequences

Items requiring students to predict consequences were difficult for students.

Recommendations: The panel recommends that all teachers assign a high priority to critical thinking in all histor ocial science classrooms. Teachers should routinely employ the critical thinking skills for which schools are now publicly accountable. The conduct of oral discussion, the design of essay assignments, and the use of cooperative problem solving are some of the primary areas in which critical thinking strategies can be employed. The critical thinking skills are described and illustrated in two documents available from the California Assessment Program: *History-Social Science: Grade 8—Rationale and Content* and *Assessment of the Critical Thinking Skills in History-Social Science.* Specific strategies for implementing the critical thinking skills in the classroom may also be found in the "Idea Sheets for Teaching Critical Thinking" that are also available from the California Assessment Program.

Differences Between Boys and Girls

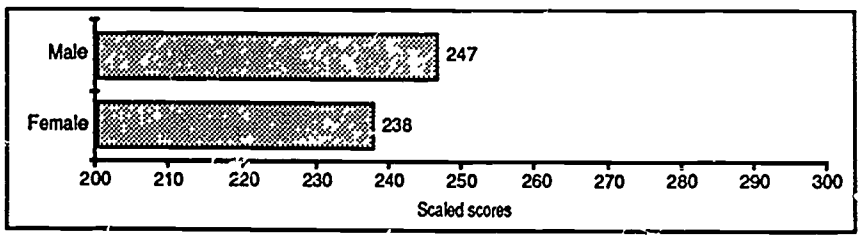


Fig. 5.23

Differences Between Boys' and Girls' Scores, 1985-86

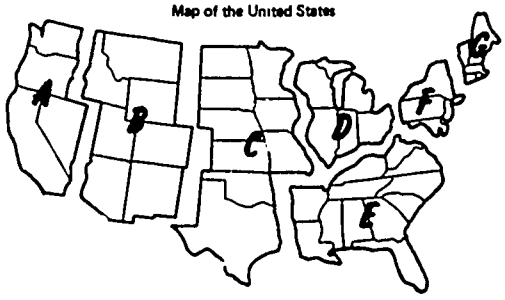
Boys continue to outperform girls in 20 of the 33 reporting categories (see Figure 5.23), even on fairly straight-forward items such as the one in Figure 5.24. A special study of the difference between the perfor-

mance of girls and that of boys in history-social science is currently underway and will be reported early in 1987.

Fig. 5.24

Disparity in Boys' and Girls' Performance

This item typifies the disparity in the performance of boys and girls in many areas of the test.



The Appalachian Mountains are located primarily in

Boys	Girls	
25%	28%	A. Region B.
17%	24%	B. Region C.
12%	15%	C. Region D.
44%	*31%*	D. Region E.

Recommendations: Teachers need to examine school expectations for the performance of girls in history-social science. Special efforts must be made to make history-social science relevant to girls as well as boys. The panel of specialists recommends that teachers emphasize the role of women in history-social science.

Conclusions and Recommendations

Teachers in history-social science departments must work as partners to explore the best ways to teach a subject area, share resources, and examine the kinds of questions that should be asked to reinforce the common core of history-social science knowledge. Articulation is essential to avoid unnecessary repetition and to provide needed reinforcement. The panel strongly recommends increased emphasis on writing as a way to improve student ability to apply and integrate history-social science knowledge. A carefully designed scope and sequence for history-social science is imperative. Because the history-social science assessment is cumulative, teachers at every grade level must understand their instructional responsibilities.

Each school's CAP report provides detailed information about school-level history-social science programs. It is no longer enough that test results indicate the general quality of school programs. Test results must be helpful to teachers and others. The statewide history-social science committee went to great lengths to build a test that provides highly detailed results at the school level. This detail is revealed in the program diagnostic display for history-social science that is contained in each school report.

It is the fervent hope of the statewide committee that administrators and teachers will make the CAP report part of their data base for evaluating history-social science programs. The results are relevant to curricula statewide and detailed enough to guide local personnel in correcting specific areas of concern. Teachers and others who want assistance are encouraged to contact regional assessment representatives listed in Appendix E.

Chapter 6

SCIENCE

The purpose of this chapter is to describe the results of the first administration of the science portion of the *Survey of Academic Skills: Grade 8*. The description will consist of summary information on each of the six major divisions of the test. This will be followed by a brief discussion of student attitudes toward science, based on 28 research questions that were a part of the assessment. The chapter ends with a statement about the role of the *Science Framework Addendum* (1984) and curriculum alignment in science education.

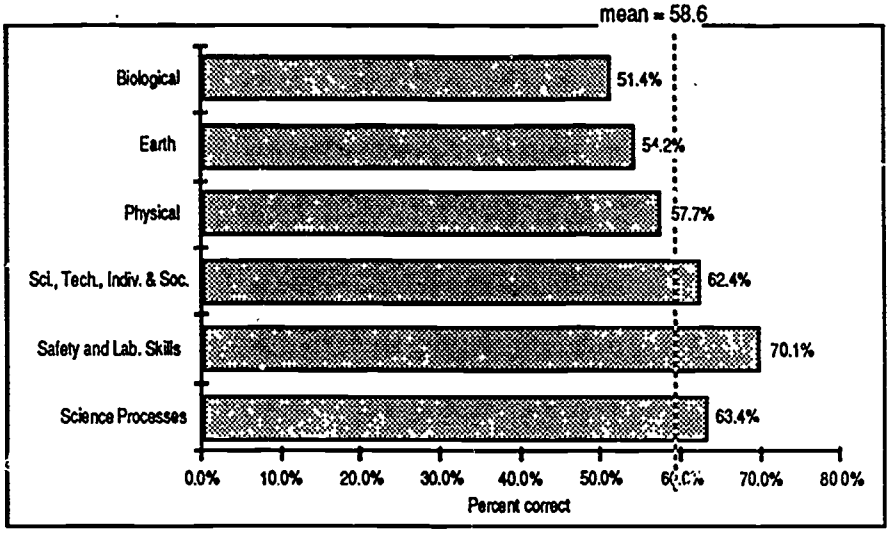
The information in this chapter is the result of an analysis of the 540 science items by members of the Science Assessment Advisory Committee. Information is reported as the percent of correct responses given by eighth graders statewide for a given area. The committee considers this information benchmark data. It gives starting points in 33 significant areas of science content and process skills. Future progress will be measured in relation to these benchmarks.

Low percent correct scores do not mean students are failing; low scores may only indicate topics that have not received adequate classroom emphasis. The *Addendum* provided the basic specifications for this assessment. In several areas, like protists and genetics, the *Addendum* called for content coverage at the middle grades that heretofore was left for the high school science program. This chapter will help identify areas that need attention.

The overall test results are shown in Figure 6.1. The low score in biological science was unexpected in view of the emphasis placed on this area at the elementary level. The results on the science process skills are encouraging, as much effort has been given this area recently. More complete discussions of those areas will follow in this chapter.

Fig. 6.1

Scores for the Major Science Categories, 1985-86



The addition of the science test to the *Survey of Basic Skills: Grade 8* has given new vigor to middle school science programs. Between the 1983-84 and 1984-85 school years, the number of middle school science classes increased by 5 percent. But even with that increase, a student still receives, on average, less than one year of science instruction in middle school.

Advisory committee members are optimistic about future improvements in science scores. The specificity of the *Science Framework Addendum* has provided science educators with an unprecedented opportunity to use the power of curriculum alignment. The test was developed as the *Addendum* was giving new direction to science curricula statewide. The selection of science textbooks for the 1986 adoption was based entirely on criteria established by the *Addendum.* Summer science training institutes and other staff development activities have also been closely tied to the *Addendum.* Now with the advent of this new science test, there is a strong professional concensus among science educators that texts, tests, and training should be aligned with the *Addendum.* This kind of alignment should provide continuous long-range improvement in the quality of science education in California.

However, weaknesses still exist. Science Assessment Advisory Committee members believe the greatest needs are in science programs from kindergarten through grade six. The addition of a science assessment at grade six would provide the same motivation for improvement in the elementary schools as it has in the middle schools.

Biological Science

Surprisingly, the biological science section received the lowest scores on the science assessment. Just over 51 percent of the questions were answered correctly (see Figure 6.2). By contrast, the two other major

content areas, earth science and physical science, had overall scores of 54.2 percent correct and 57.7 percent correct, respectively.

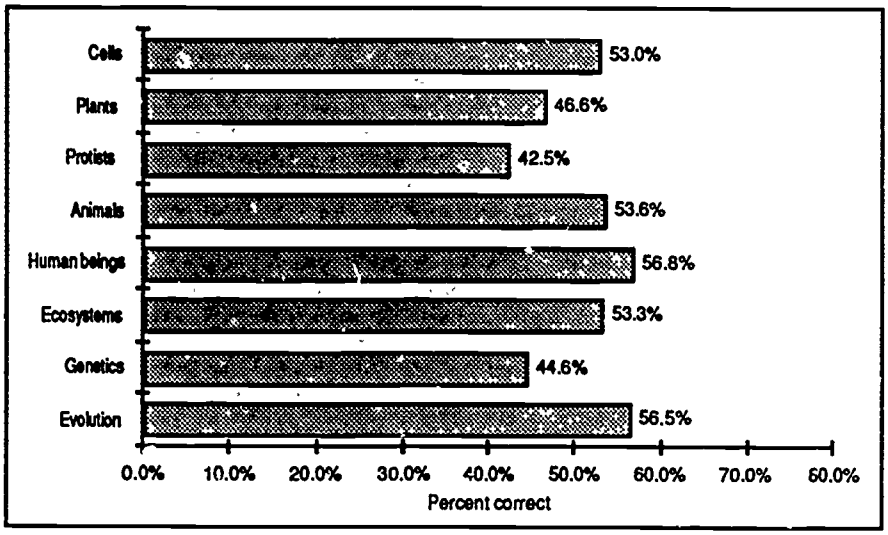


Fig. 6.2

Scores for Categories Within Biological Science, 1985-86

Within the biological sciences, students scored highest on questions dealing with human beings (56.8 percent) and evolution (56.5 percent). The high scores in the human beings category correlate well with the amount of time students claim to have devoted to this topic.

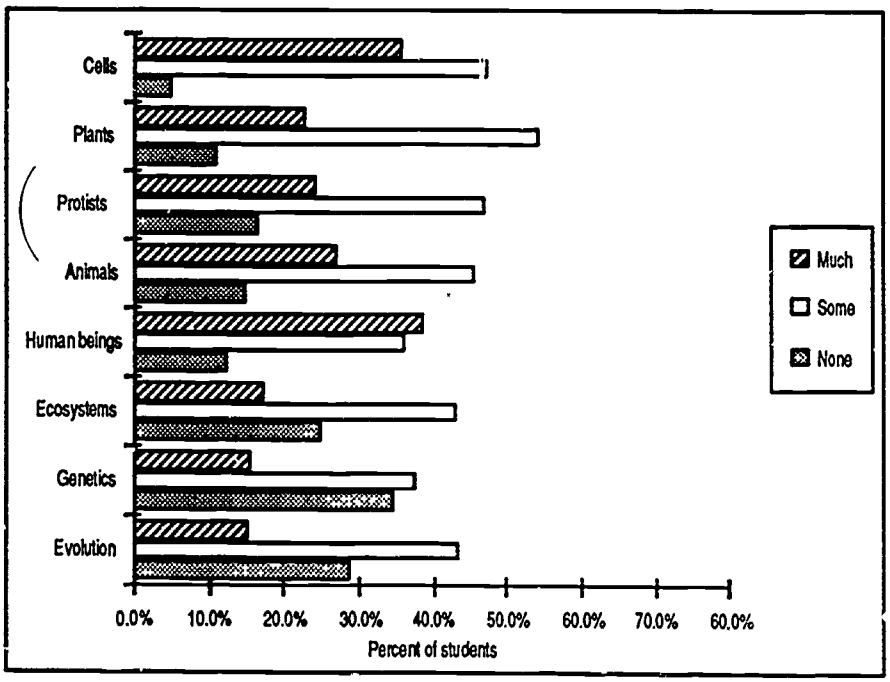


Fig. 6.3

Class Time Devoted to Biological Science Topics, 1985-86

Students also scored comparatively well on the evolution questions, even though they did not receive an especially great amount of training in evolution (see Figure 6.3). Despite the limited treatment of evolution by most textbooks, students have a fairly good understanding of the concepts tested. The committee could only speculate that students are probably learning about evolution from sources other than textbooks.

It is not surprising that the area of protists had the lowest percent correct score on the entire test (42.5 percent). The individual organisms are microscopic; their functions are not visible and thus are described only verbally (for example, one cannot observe yeasts breaking down sugar, producing carbon dioxide, and thus raising bread dough); the decay process is lengthy; few schools have microscopes that make protists truly observable; and many protists, such as molds, are not fully safe to work with in classrooms. Very little actual experimenting can be done, so most kindergarten through eighth grade knowledge of protists is acquired by reading.

Genetics had the next-to-lowest score on the entire test (44.6 percent). Most students are not taught genetics in junior high; if they are taught genetics, it is usually in the abstract.

It is surprising that the skill area assessing knowledge of plants was the third lowest on the entire test (46.6 percent). The assessment of the vocabulary of plant structures resulted in many low-scoring items. Unfamiliarity with the function of plant parts produced some low scores. The highest-scoring question in the skill area of plants turned out to be possibly as related to social studies as to science: "Why did farmers bury fish near corn plants?" The students were unable to relate their everyday experiences with plants to the vocabulary and concepts.

The expectation that students would do best in the life sciences was not borne out in the test results. Based on these results and the time spent studying them, it would seem that more time should be given to the topics of protists, genetics, and plants. There is great need for appropriate hands-on and discovery-oriented activities in these areas, activities that also facilitate the acquisition of key vocabulary. For example, if terms such as cilia, flagella, pseudopods, and trichocysts are unfamiliar, then students should have the opportunity to observe these structures in living pond water under a microscope.

Earth Science

Overall, the Science Assessment Advisory Committee was pleased with the earth science results. They show that students study at least some areas in the earth sciences and retain information about them. Among the four major earth sciences, students know most about astronomy and geology by the eighth grade. Statewide, students answered 59 percent of the questions in these areas correctly (see Figure 6.4). Students fared much more poorly on questions about meteorology and oceanography. They answered only 47 percent of the questions in these areas correctly.

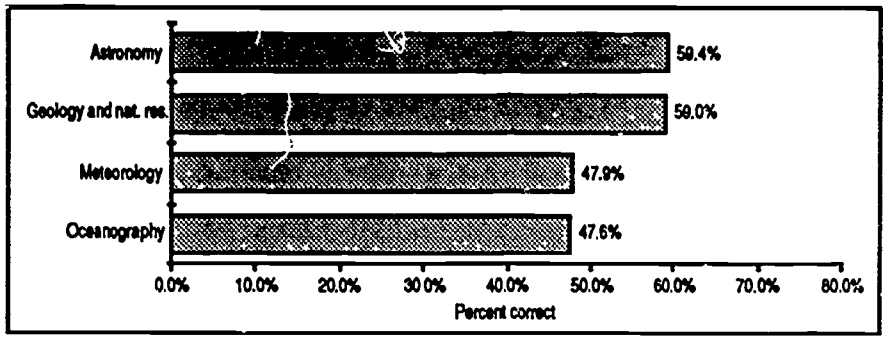


Fig. 6.4

Scores for Categories Within Earth Science, 1985-86

Astronomy

In astronomy, students did very well on questions concerning the causes of seasons and the causes of day and night. Students had an apparent knowledge of gravitation, solar energy and galaxies. The highest score on an item in astronomy dealt with light-years (see Figure 6.5). Students did not do as well in orientation to north, south, sunrise, and sunset. There was considerable confusion on eclipses.

A light-year is

80.2%	A. the distance light travels in one year.
9.6%	B. about one million kilometers.
5.7%	C. a parsec.
3.4%	D. an angstrom.

Fig. 6.5

Definition of Light-Year

Students scored higher on this item than on any other in astronomy, including ones concerning orientation to basic compass directions.

Geology and Natural Resources

On the geology and natural resources questions, students were most successful (over 70 percent) in the topics on the causes of earthquakes and the identification of rock layers from a cross section. Students also did well in sediment identification, composition of rocks and minerals, the nature of mountains, flood dangers, some aspects of volcanism, and some aspects of erosional forces.

Students did not score well on questions on the effects of volcanic dust on the atmosphere, erosion agents, the composition of continental crust, the definition of nonrenewable versus renewable resources, and the composition of sedimentary rocks.

Meteorology

Meteorology topics were the most difficult in the earth science section. To turn a phrase, everyone talks about the weather but apparently no one teaches about it. Students scored well on only two questions—on the sun's effect on the weather and on the formation of dewdrops. Students scored low on the dynamics of the atmosphere, the prediction of weather, the water and carbon dioxide cycles, and the Coriolis effect.

Oceanography

In the earth sciences section of the test, questions dealing with oceanography had the lowest percentage of correct answers. Out of 16 questions, seven of them were areas of relative weakness. Ocean basins and the ocean's resources were topics of relative strength. Students had difficulty on topics dealing with the effect of solar radiation on the oceans, the causes of and effects of ocean waves, the parts of the ocean, the causes of tides, and the chemical composition of sea water.

Physical Science

The reporting categories with the highest scores on the physical science section of the test were physical states and changes in matter, sound, and electricity and magnetism (see Figure 6.6). Scores in these areas were all above the overall test score of 58.6 percent correct.

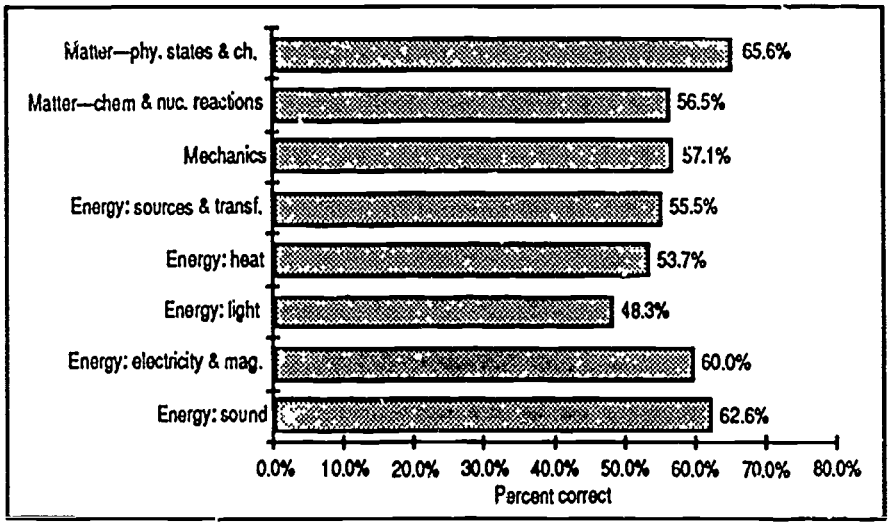
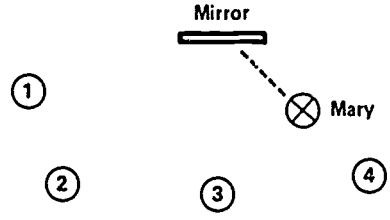


Fig. 6.6

Scores for the Categories Within Physical Science, 1985-86

Students had the most difficulty on questions dealing with light, especially those involving understanding concepts rather than recognizing vocabulary. In the question in Figure 6.7, students are asked to select the position of an object seen in a mirror from a certain vantage point rather than identifying the law of reflection.



Mary is standing, looking into a mirror as shown in the diagram above. In the mirror Mary sees John's reflection. Where is John star. ing?

Fig. 6.7

Concepts Concerning Light

In relation to light, students had more difficulty with concepts than with vocabulary.

2.9% A. 1
32.6% B. 2
48.3% C. 3
13.7% D. 4

Apparently concepts dealing with light are not widely taught. Because these concepts are easily demonstrated and lend themselves to interesting classroom experiments, this situation should not be difficult to correct. The materials are easily obtained and inexpensive.

In mechanics, two areas need more attention—gravity and potential energy. Students do not associate weaker gravitational fields with smaller masses. The fact that energy involves motion and position is not understood.

The following sets of related major topics are not well differentiated by students:

- Pressure and force
- Velocity and acceleration
- Radiation, convection and conduction
- Laws of magnetic attractions and repulsion
- Laws of attraction and repulsion of electric charges
- Wave length and frequency

Science, Technology, Individuals, and Society

Science processes and products items involve knowledge of how scientists obtain and process information and what kinds of problems lend themselves to scientific inquiry (see Figure 6.8). The highest scoring

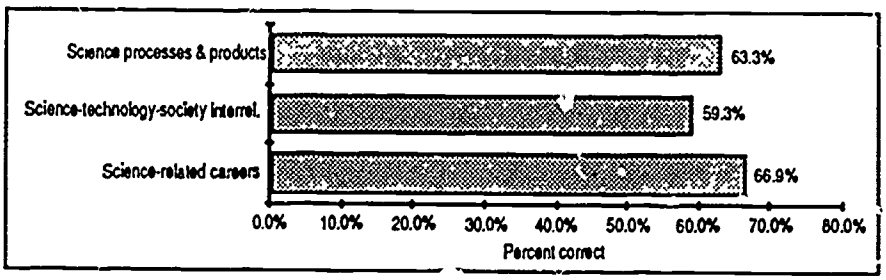


Fig. 6.8

Scores for the Categories Within Science, Technology, Individuals, and Society, 1985-86

items involve identifying problems that are susceptible to scientific inquiry and those that are not (e.g., "Which planet is the most beautiful?") Scores were also high on questions asking students to identify scientific research as the cause of changes in thinking (e.g., research linking smoking to health problems). The items on which scores were lowest involve vocabulary for labeling examples of science

processes (e.g., *control, hypothesis.*). Figure 6.9 contains an example of such an item.

Fig. 6.9

Science Process Vocabulary

In the area of science, technology, individuals, and society, students scored lowest in vocabulary related to the processes and products of science.

While you are walking through a redwood forest on a hillside, you notice that many of the old tress have been damaged by fire and that the damage has frequently occurred on the uphill side of the trunk. You ask yourself, "I wonder why the uphill sides of the tree trunks seem to get burned?" What you have just done is

63.2% A. stated a problem.
10.1% B. made a prediction.
12.4% C. performed an experiment.
12.5% D. formed a conclusion.

Items on science-technology-society interrelationships involve matching prominent scientists with their major contributions, identifying effects of some real and hypothetical scientific and technological advances, and relating technological devices to scientific advances they made possible. The highest scoring items in this group involved identifying effects and uses of vaccines and biomedical research, astronomical instruments, and television (see Figure 6.10). Vocabulary problems seemed to be responsible for the difficulty of some items. Regarding prominent scientists, students recalled Newton's contribution but failed to recognize Mendel's work. Mendel's lack of recognition is consistent with the low genetics scores in the biological science subtest, which, in turn, may have resulted from the minimal time devoted to genetics, as reported in the research question data.

Fig. 6.10

Effects of Science Processes

Students generally did well on this type of item, although vocabulary problems seemed to cause difficulty on some.

One benefit of pasteurization is that

57.9% A. milk keeps longer because bacteria are killed.
7.4% B. milk and cream are no longer separated.
17.4% C. more milk is produced by cows that are immunized.
11.4% D. plastic cartons have replaced glass milk bottles.

Items on careers required students to relate specific careers to areas of science or to specific scientific/technological advances and to identify levels and kinds of preparation needed for certain careers (see Figure 6.11). The items with the lowest scores related to how science knowledge might be useful to a lawyer. The item on which students did best dealt with the need for mathematics preparation for architecture.

Fig. 6.11

Science-Related Careers

This is a typical careers item, both in type and score.

A newspaper ad reads: HIGH SCHOOL GRADUATES Jobs for high school graduates, no experience necessary, on-the-job training. Call 222-2222. This ad could apply to all of the following jobs except

HIGH SCHOOL GRADUATES
Jobs for high school graduates, no experience necessary, on-the-job training. Call 222-2222.

8.5% A. drugstore clerk.
21.5% B. beekeeper.
6.6% C. cashier.
61.6% D. food chemist.

At 62.4 percent, results on the whole for this area were relatively strong. Some improvement in performance could result if, during

hands-on laboratory activities and post-lab discussions, teachers would point out and label processes and products such as hypotheses, controls in experiments, and scientific laws. More time and effort devoted to the study of heredity and genetics should not only improve the biology scores but also rescue Father Mendel from his undeserved unfamiliarity among eighth graders.

Safety and Manipulative Skills

The highest percent correct for a major division of the test (70.1 percent) was achieved on safety and manipulative skills questions (see Figure 6.12). This score reflects instructors' awareness of the importance of safety consciousness and correct use of laboratory equipment.

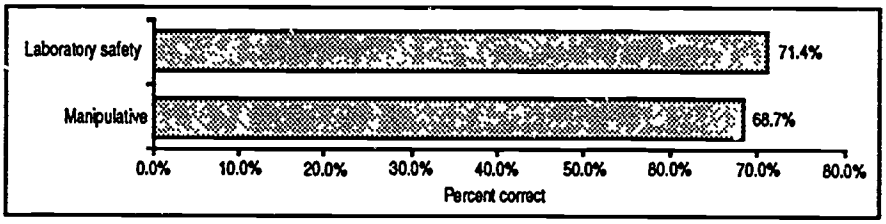


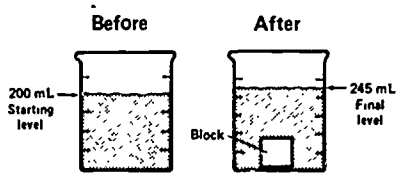
Fig. 6.12

Scores for the Area of Safety and Manipulative Skills

Students tended to answer "common sense" questions correctly, i.e., those about situations occurring in other curriculum areas as well as in science. Eight of the 29 items in this division were above the 82 percent correct level. Students also did well on questions based on knowledge of basic science vocabulary.

On questions assessing knowledge of the uses of laboratory equipment, students scored over 60 percent on 15 of 29 items (see Figure 6.13 for example).

Gwen placed a small block in a beaker of water. She was able to record that



Displaced volume = Final level − Starting level

9.2% A. since the block sank, the displaced volume cannot be measured.
7.9% B. the displaced volume is 5 milliliters.
64.9% C. the block has a volume of 45 milliliters.
16.7% D. the block has a volume of 245 milliliters.

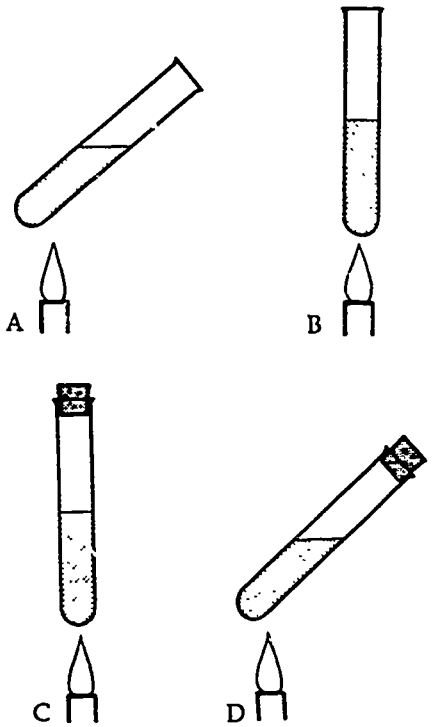
Fig. 6.13

Uses of Laboratory Equipment

Students did well on this type of question, especially when scores are compared with those on items such as the one in Figure 6.14.

Questions students missed most often were in areas in which understanding is based on actual laboratory experience (e.g., using chemicals and special equipment). Compare the score for the item in Figure 6.14 with that in Figure 6.13.

Which of the following illustrates the correct method of heating a liquid in a test tube?



28.5% A.
39.1% B.
17.7% C.
12.9% D.

Fig. 6.14

Laboratory Experience

Compare the very low scores on this item (25 percent could be expected from pure guessing) with that of the item in Figure 6.13.

In summary, grade eight students in California exhibited a reasonable degree of "common sense" safety awareness in typical classroom situations. However, it is obvious from the data that increased time in the laboratory is essential to strengthen students' knowledge of safe and appropriate methods of using of chemicals and laboratory equipment.

Science Thinking Processes

"Science thinking processes" are defined in the *Science Framework for California Public Schools* (1978) as "the cognitive processes involved in scientific inquiry as well as those processes that are basic to all rational thinking." These processes, which are outlined in the 1984 *Science Framework Addendum*, include "general" cognitive skills such as observing, comparing (which includes measuring), and organizing (e.g., data gathering and classifying). More sophisticated cognitive skills, such as relating, inferring, and applying, are developed cumulatively from practice in the general processes.

The science thinking process skills assessed on the eighth grade CAP science test differ from other parts of the science test in that they are not

content specific. The thinking skills are common to all academic disciplines but for the purposes of the test are placed conceptually into the framework of the scientific enterprise. Thus, students learn to think rationally in all their educational experiences, and the assessment of these skills on the science test is an attempt to measure the extent to which rational thinking is nurtured and applied in science classes.

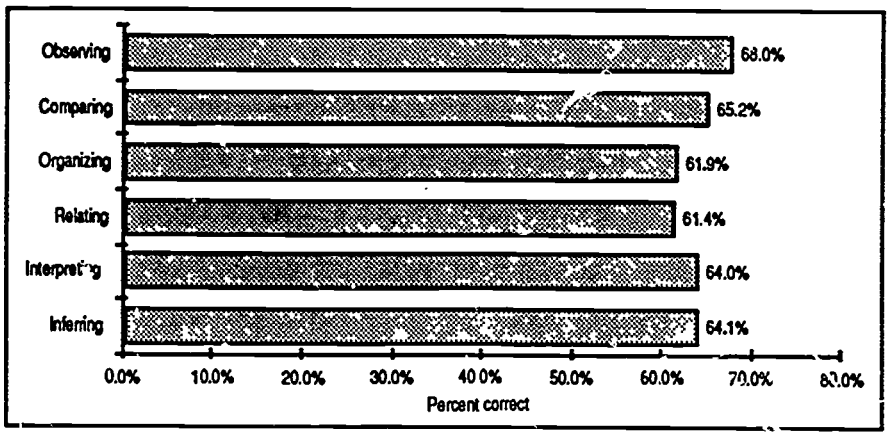
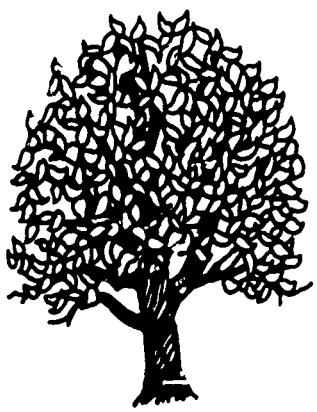


Fig. 6.15

Scores for Science Thinking Processes

The graph of the results of the thinking process portion of the test indicates that the most general thinking process, observing, was the skill in which the greatest number of students were successful. Intuition would probably lead one to expect that to be true and that each succeeding skill would be more difficult. The theory, while generally correct, can be misleading because there may be a gradient of difficulty within each level of the hierarchy. For example, among the observing questions, 90.5 percent of the students correctly answered the question in Figure 6.16. In this case they were directly observing a picture on the test form. On another item students were asked to observe an image that they had to create in their minds. Only 42.5 percent of the students answered the question correctly, indicating that symbolic thinking is difficult for children in the eighth grade, even when the most elementary skill is being measured.



Which one of the following can you directly observe about the tree in the above illustration?

4.5% A. The tree reproduces by seeds.

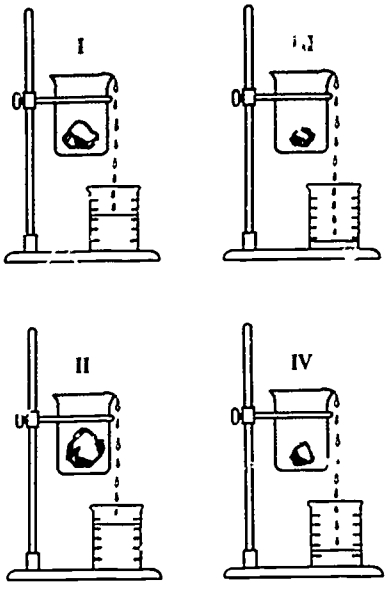
Fig. 6.16

Direct Observation

This type of item was obviously easy for students, unlike similar questions that called for them to create a mental image.

3.0% B. The tree has deep roots.
90.5% C. The tree has many leaves.
1.2% D. The tree grows in California.

Comparing items produced a wide range of scores because of their varying difficulty. The overall average (65.2 percent) was slightly lower than that for observing items. The comparing task on the question with the most correct responses (93.6 percent) involved rather simple observation skills (see Figure 6.17). The question on which students did most poorly engaged the students in a moderately difficult observation and a sophisticated measurement of an angle, done purely by inspection. Generally, students responded poorly on word problems or problems that required some degree of mental visualization.



Objects were placed in containers filled with water, as shown above. Students observed that different amounts of water overflowed from each container.

Which of the following objects have the same volume?

1.6% A. I and V
2.3% B. II and III
93.6% C. I and IV
0.9% D. II and V

Fig. 6.17

Simple Comparisons

As with observation skills, students did very well at comparisons involving images presented to them and poorly on ones that required mental images.

The students were least successful on organizing questions (61.9 percent) and relating questions (61.4 percent). Students did well on organizing tasks which required simple observing and comparing skills (see Figure 6.18) and poorly on questions that were not based on direct observation and comparison (see Figure 6.19).

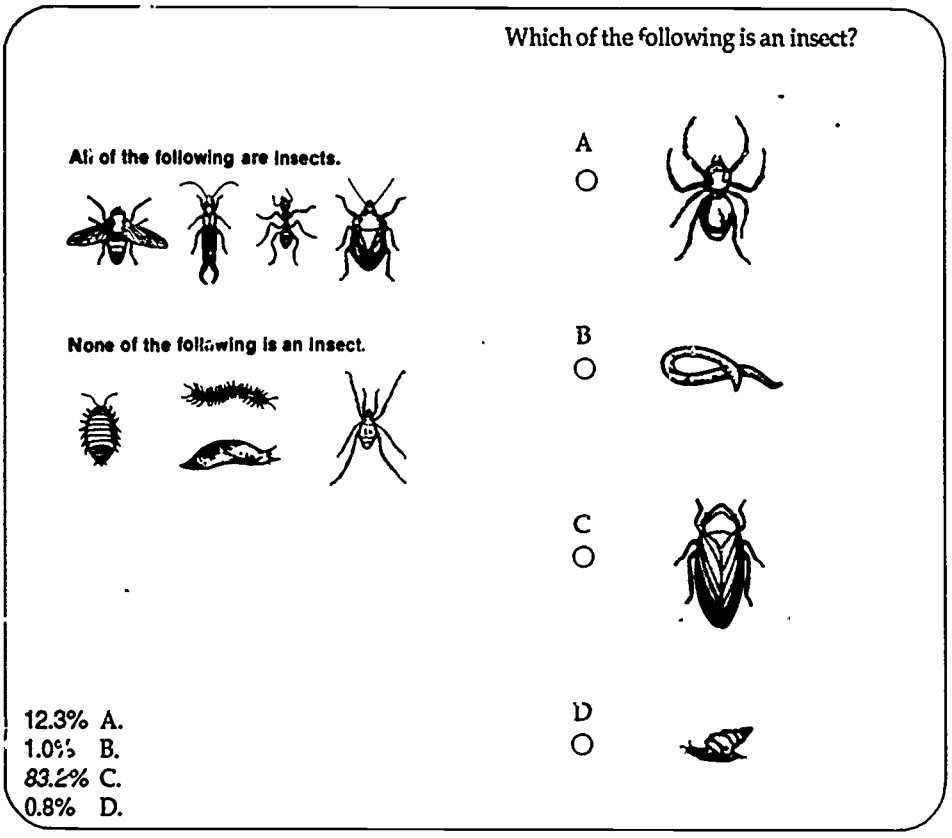


Fig. 6.18

Organizing Through Direct Observation

Students were generally successful on organizing tasks involving direct observation.

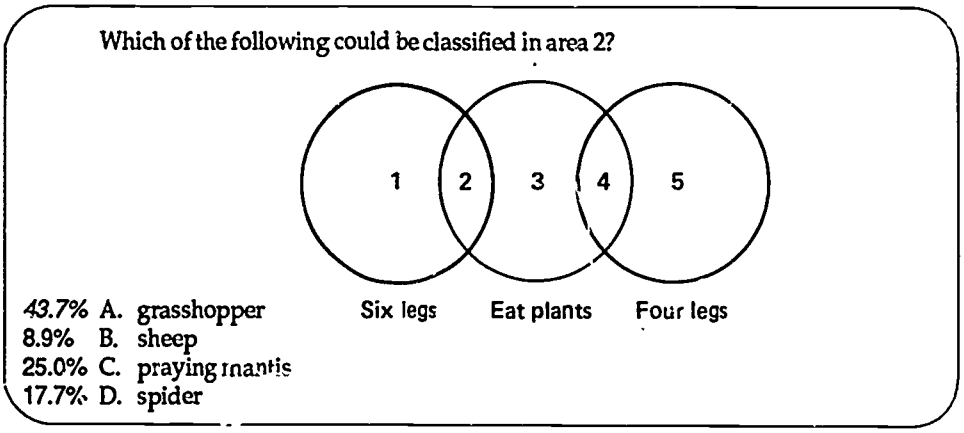


Fig. 6.19

Organizing Without Direct Observation

Students were not nearly as successful at this sort of abstract classification task as they were on ones involving direct observation.

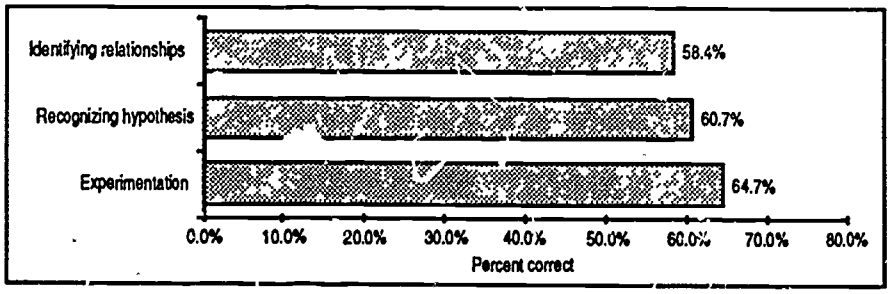


Fig. 6.20

Scores for Relating Tasks

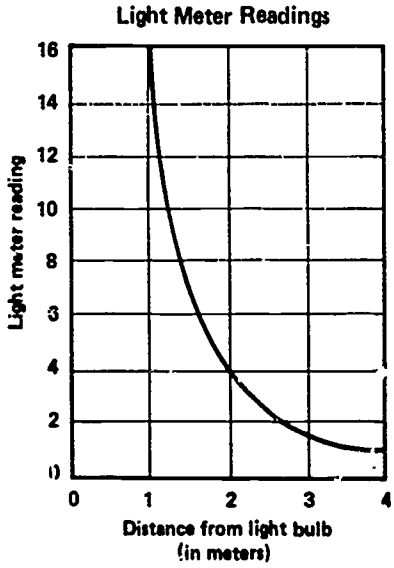
The relating questions have been subdivided into three categories: identifying relationships, recognizing hypotheses, and experimentation (see Figure 6.20). Identifying relationships appears to be an area of weakness, the average score being 58.5 percent correct. Interpreting graphs (34.3 percent) was much more difficult than observing graphs (79.9 percent) or than orienting oneself with the help of reference points

(81.9 percent). See figures 6.21 through 6.23 for examples in these areas. When students were asked to recognize hypotheses, 86 percent of the questions that included a picture had student responses above the mean for the recognizing hypotheses section (60.7 percent). When a picture was not part of the question, only 31 percent of the questions had scores above the mean. Students did relatively well on experimentation questions (64.7 percent).

Fig. 6.21

Interpreting Graphs

This type of item is much more difficult for students than observing graphs (see Figure 6.22).



At a distance of 4 meters from a light bulb, a light meter shows a reading of 1. According to the graph above, what will the light meter reading be at half the distance?

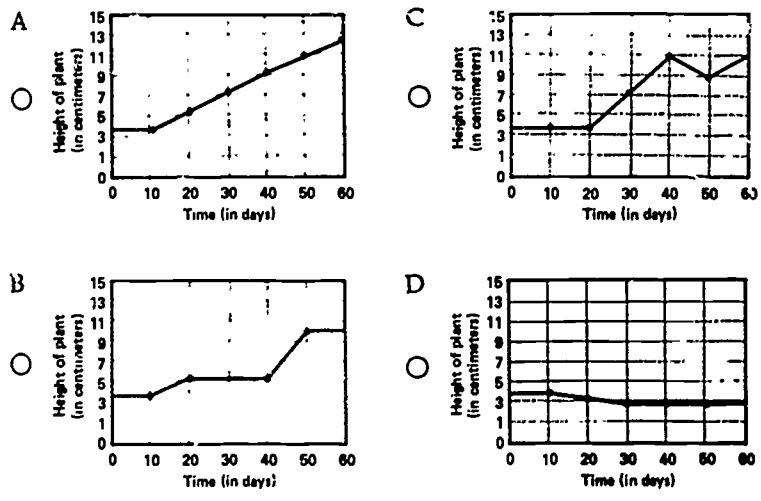
6.7% A. 1
31.4% B. 1.8
24.2% C. 2
34.3% D. 4

Fig. 6.22

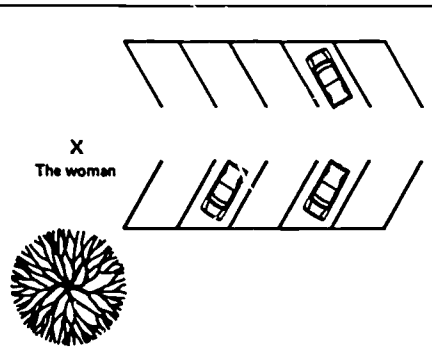
Observing Graphs

Students do well when reading information directly from graphs (compare Figure 6.21).

The graphs below show the growth rate of four house plants that have been fertilized every ten days for 60 days. Which one of the following graphs represents a steady increase in plant growth after fertilization?



79.9% A.
9.5% B.
4.0% C.
5.5% D.



From the top of a tall building, you see a tree, a parking lot, and a woman, as shown in the diagram above. The tree is on the woman's right. Where is the parking lot?

81.9% A. in front of the woman
5.8% B. behind the woman
6.1% C. to the woman's left
5.1% D. to the woman's right

Fig. 6.23

Orienting by Reference Points

This is another form of direct reading of information at which students do well (compare figures 6.21 and 6.22).

The processes of interpreting and inferring are the most sophisticated processes tested in the eighth grade science test. However, performance on these questions was stronger (64.1 percent correct overall; 64.0 percent correct on interpreting; and 64.1 percent on inferring) than on organizing and relating questions. These items are the most dependent on the preceding process skills. The difficulty of the question can in many cases be related to the difficulty of a less sophisticated process skill, which may form a significant part of the question. Data from these questions must be reviewed in light of the difficulty of assessing students' ability to make inferences and interpret complex data sets with a multiple choice format. For instance, when data were already compiled students did predictably well at interpreting the information (see Figure 6.24). When the data sets required comparison before interpretation, students did not perform as well (see Figure 6.25).

This table shows the best conditions for growing several plants.

Plant	*Temperature*	*Light*	*Type of soil*
Moss	Cool	Low to moderate	Damp or muddy
Fern	Cool	Moderate	Damp and sandy
Sundew	Cool to moderate	Moderate	Muddy and wet
Daisy	Warm	Bright	Dry and sandy

Which one of the following statements best describes the growing environment for moss?

88.1% A. cool, low light, damp soil
4.7% B. bright light, cool, damp earth
2.4% C. dry, bright, warm, sandy soil
4.1% D. warm, low light, damp soil

Fig. 6.24

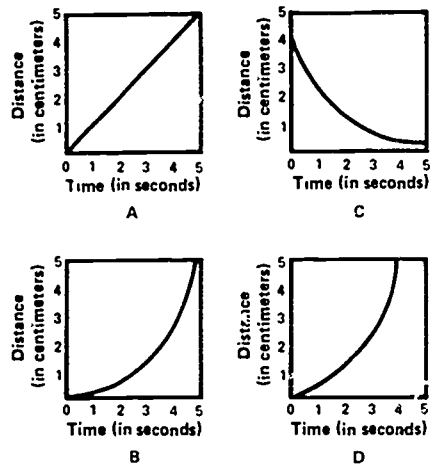
Direct Interpretation

Students score well when data are compiled for them (compare Figure 6.25).

Fig. 6.25

Comparison and Interpretation

Students' scores are much lower on this sort of item than on ones in which the data information can be read directly (compare Figure 6.24).



On the basis of the graphs above, which one of the following is a correct interpretation?

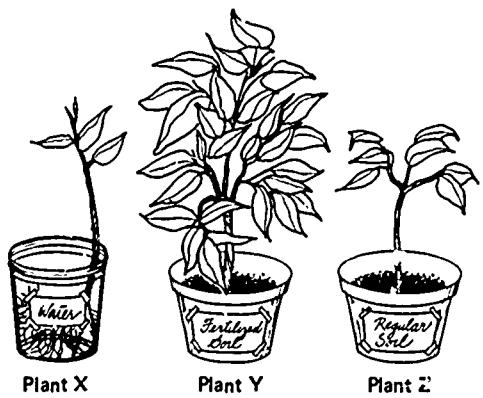
13.1% A. Graphs B and D represent objects that are speeding up.
27.9% B. Graph A represents an object moving at a constant speed.
11.5% C. Graph C represents an object that is slowing down.
44.0% D. All of the above are correct interpretations.

The observations about students' interpreting skills also apply concerning their ability to make inferences. When an inference was to be made on the basis of simple observations, students performed well (see Figure 6.26). Students also performed above the mean on all questions which involved extrapolation or interpolation (see Figure 6.27), two commonly used deductive processes. Performance was weak when students were asked to make an inference that required using a time frame other than the immediate present (Figure 6.28).

Fig. 6.26

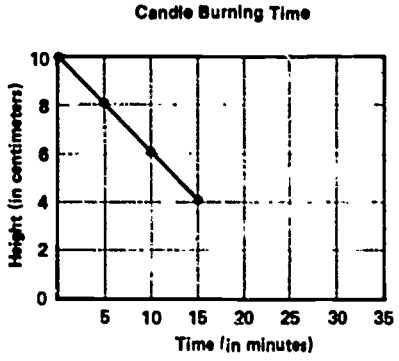
Simple Inferences

Compare students' score on applying deduction directly (also see Figure 6.27).



Which one of the following conclusions is best supported by the above illustration?

1.1% A. Plants grow better in water.
2.2% B. Plants grow better in regular soil.
1.3% C. Plants grow better in glass pots.
93.4% D. Plants grow better in fertilized soil.



Jack burned a 10-centimeter candle and measured it every 5 minutes. When will it burn out?

14.1% A. 20 minutes
74.2% B. 25 minutes
6.8% C. 30 minutes
3.5% D. 35 minutes

Fig. 6.27

Direct Extrapolation

Students seem to find direct deduction fairly easy (compare this item with those in figures 6.26 and 6.28).

Recently, some forests were cleared in the Himalayan Mountains. What conditions would most likely occur as a result of this clearing?

27.1% A. Colder weather would occur in the hills.
14.9% B. Less rain would fall on the plains below.
11.2% C. Snow would fall in the mountains.
44.8% D. Floods would occur on the plains below.

6.28

Inferences Beyond Present Time

Leaving the time frame of the immediate present seemed relatively difficult for students.

The Science Assessment Advisory Committee drew several general conclusions and made related recommendations on the basis of the answers to the questions on the thinking process skills that were measured on the eighth grade science test. It is important to remember that the eighth grade test measures the cumulative growth and development of a sequence of processes in individuals through nine years of schooling. The recommendations made here should not be interpreted in a way that places inferential thinking in early grade levels but rather supports the *Science Framework Addendum's* recommendation that each process has a best time for emphasis in children's schooling.

- Within each thinking process category there is a range of difficulty. Students generally perform well when their intuition is assessed, poorly when formal operational skills are assessed. Performance drops dramatically when there is a transition from questions with pictures to questions without pictures. The science curriculum should reinforce intuitive skills and expose students to increasingly complex organizing, relating, and inferring processes.
- Students are weak at problem solving. The trouble often seems to be related to the inability of the students to translate words into a mental visualization of what is described. It is difficult at this point to know whether students perform weakly on the higher process supposedly being assessed or whether the inability to visualize the problem presents a roadblock that prevents students from solving the problem. Teachers should integrate more

problem solving into the curriculum, particularly problems in which students are required to visualize a scenario and operate on the basis of their visualization.

- Cause and effect relationships appear to be weakly developed at the eighth grade level. Evidence from the inferring category shows students found difficulty in understanding cause and effect, especially when asked to make temporal judgments about events in the past or future. The curriculum should be designed to include cause and effect relationships.
- Students do well when reasoning deductively, probably because the deductive approach may be the most extensively used technique in science teaching. We recommend that more instructional activities be inductive in design. Students should be provided a learning situation in which they can discover concepts and principles, and more emphasis should be placed on inquiry-oriented laboratory activities.
- Students should be moved from concrete material through representational material to abstract thinking about that material. This should be done within each grade level, even at the lower grade levels—e.g., sorting real leaves (concrete material), followed by sorting pictures of leaves (representational material), and then sorting cards with the names of the leaves on them (abstract thinking).

Research Questions

The section of the grade eight CAP science test designed to reveal student attitudes about science instruction produced some interesting information. The following is a summary of the information collected from the 28 science research questions matrixed throughout the assessment. From 7,500 to 15,000 students responded to each question. The full questions and all response data are in Appendix F. The numbers in parentheses correspond to question numbers in Appendix F.

Students indicated a strong interest in science (1, 11) and saw it as beneficial to society and useful in the solution of social problems (12, 13). They found science personally helpful in "thinking and solving problems" and expressed particular enjoyment of "hands-on" experimentation (2, 4). Also positive were their responses to gender-related questions. Males and females were viewed equally in terms of who gets the best grades and the most value from science education (16, 17, 18).

Questions on the application of science in society produced more divided responses (14, 19). Students were also uncertain about the value of scientific methods for solving everyday problems. They were evenly divided in their interest in activities outside the classroom or in reading, writing, or viewing television programs about science (3, 10, 15). Just over half discussed their science project with their parents (8).

Particularly disappointing was the students' limited awareness of the correlation between science and good health practices (9). They also saw science as relatively unimportant to their personal or future career plans (7).

Of particular interest and concern were the answers to questions on teaching techniques. An overdependence on textbooks correlated closely with too few opportunities for doing experiments in class (24, 25). Field trips were severely limited, suggesting a need to use TV/VCR programs as alternatives (26). Although students perceived their science labs as being well-equipped, responses indicated they were not using many of the "tools" essential to good science education (23, 28). It was clear that while students enjoy "hands-on" science, they have too few opportunities to experience it, a problem directly related in their failure to relate the processes of science to everyday interests and concerns.

Introduction

APPENDIX A

Estimated National Percentile Ranks of Median California Grade Three Students' Performance 1966-67 Through 1985-86

Content area/ test and norms	Estimated percentile rank, by year administered																		
	Stanford Achievement Test					Cooperative Primary Reading Test (1956 Norms)		CAP Reading Test*	CAP Reading Test** (Revised)					CAP Survey of Basic Skills***					
	66-67	67-68	68-69	69-70	70-71	71-72	72-73	73-74	74-75	75-76	76-77	77-78	78-79	79-80	80-81	81-82	82-83	83-84	84-85	85-86
Reading																				
Stanford																				
1963 norms	34	34	36	36	38															
CPRT																				
1966 norms						52	52	52												
CTBS																				
1973 norms									55	55	56	57	58	58	59	60	62	64	69	71
1981 norms																41	45	46	54	55
Stanford																				
1982 norms																45	47	49	50	51
Language																				
CTBS																				
1973 norms														53	54	56	57	59	64	66
1981 norms																40	42	43	49	51
Stanford																				
1982 norms																44	47	50	53	54
Math																				
CTBS																				
1973 norms														51	52	55	59	62	63	67
1981 norms																44	50	53	56	63
Stanford																				
1982 norms																52	53	57	60	62

* The *Reading Test* was first administered in 1973-74. The percentile ranks are based on an equating study of the *Reading Test* and the *Cooperative Primary Reading Test*, Forms 23A and 23B, normed in 1966.

** The revised *Reading Test* was administered to all California students in 1974-75, 1975-76, 1976-77, 1977-78, and 1978-79. The percentile ranks are based on equating studies of the revised *Reading Test* and the *Comprehensive Tests of Basic Skills*, Form S, normed in 1973.

*** The new *Survey of Basic Skills: Grade 3* was administered to all California students in 1979-80 through 1984-85. The estimated national percentile ranks are based on an equating study of the new test and the *Comprehensive Tests of Basic Skills*, Form S, normed in 1973. For 1981-82 through 1984-85, the percentile ranks are also given for the 1981 edition of the *CTBS* and the 1982 edition of the *Stanford Achievement Test*.

Estimated National Percentile Ranks of Median California Grade Six Students' Performance 1969-70 Through 1985-86

Content area/test and norms	Estimated percentile rank, by test administered: *Comprehensive Tests of Basic Skills (CTBS)* (1968 Norms) 1969-70	1970-71	1971-72	1972-73	1973-74	*Survey of Basic Skills** 1974-75	*Survey of Basic Skills*** 75-76	76-77	77-78	78-79	79-80	80-81	81-82	82-83	83-84	84-85	85-86
Reading																	
CTBS																	
1968 norms	48	46	44	44	44	48											
1973 norms							53	53	55	55	56	57	58	57	56	57	59
1981 norms													53	52	51	53	54
Stanford																	
1982 norms													52	52	52	52	52
Language																	
CTBS																	
1968 norms	43	43	39	39	37	43											
1973 norms							49	51	51	52	53	55	57	58	58	60	62
1981 norms													48	49	49	52	54
Stanford																	
1982 norms													49	50	51	57	62
Mathematics																	
CTBS																	
1968 norms	47	43	38	38	38	44											
1973 norms							50	51	53	54	55	56	58	60	61	62	64
1981 norms													59	60	61	62	66
Stanford																	
1982 norms													52	52	56	57	59

* The new California test, the *Survey of Basic Skills: Grade 6*, was first administered to all California pupils in 1974-75. The percentile ranks are based on an equating of the *Survey of Basic Skills* and the *Comprehensive Tests of Basic Skills* (*TBS*), Form Q, which was normed in 1968.

** The revised version of the *Survey of Basic Skills: Grade 6* was administered from 1975-76 through 1980-81. A second revision of the test was first administered in 1981-82. The percentile ranks, since 1974, are based on equating of the *Survey of Basic Skills* to three editions (1968, 1973, 1981) of the *Comprehensive Tests of Basic Skills* (*CTBS*) and the latest edition (1982) of the *Stanford Achievement Test.*

Estimated National Percentile Ranks of Median California Grade Eight Students' Performance, 1983-84 Through 1985-86

Content area/test and norms	Estimated norm 1983-84	1984-85	1985-86
Reading-- CTBS, 1981	39	34	36
Written Expression-- CTBS, 19	50	49	49
Mathematics-- CTBS, 1981	48	48	49

NOTE: The *Survey of Academic Skills: Grade 8* was first administered in 1983-84. The estimated national norms are based on an equating study of the new test and the latest edition of the *Comprehensive Tests of Basic Skills*, Form U, normed in 1981.

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Estimated National Percentile Ranks of Median California Grade Twelve Students' Performance 1967-68 Through 1985-86

Content area/test and norms	Estimated percentile rank, by test administered																
	Iowa Tests of Educational Development Form X, normed in 1962					*Survey of Basic Skills**	*Survey of Basic Skills** (Revised)										
	69-70	70-71	71-72	72-73	73-74	74-75	75-76	76-77	77-78	78-79	79-80	80-81	81-82	82-83	83-84	84-85	85-86
Reading																	
ITED																	
1962 norms	52	49	49	47	47	41	43	42	42	41	41	42	42	41	39	41	41
1978 norms												44	44	44	41	43	42
TAP																	
1970 norms						33	35	33	32	32	32	33	32	32	29	31	31
1978 norms												42	42	41	40	41	41
STEP																	
1970 norms						34	38	36	35	34	34	35	35	34	33	34	34
1978 norms												47	47	47	45	47	47
Language																	
ITED																	
1962 norms	42	40	38	36	34	32	34	33	34	34	34	35	35	34	30	35	36
1978 norms												43	43	43	40	43	44
TAP																	
1970 norms						25	27	26	26	27	27	29	29	28	27	29	29
1978 norms												40	41	40	38	40	40
STEP																	
1970 norms						27	29	28	28	28	28	30	30	30	29	30	31
1978 norms												57	57	57	55	57	57
Math																	
ITED																	
1962 norms	48	48	48	48	48	41	44	43	43	43	44	46	46	46	45	47	48
1978 norms												46	45	45	45	47	48
TAP																	
1970 norms						38	43	41	41	41	42	44	44	44	43	45	46
1978 norms												41	41	41	40	41	43
STEP																	
1970 norms						41	44	43	43	43	43	47	47	47	45	48	49
1978 norms												55	55	55	55	59	61

* The California test, the *Survey of Basic Skills: Grade 12*, was administered to all California students from 1974-75 through 1985-86. The percentile ranks are based on equating studies of the *Survey of Basic Skills* and three other tests with national norms: (1) *Iowa Tests of Educational Development*, normed in 1962 and 1978; (2) *Tests of Academic Progress*, normed in 1970 and 1978; and (3) the *Sequential Tests of Educational Progress*, normed in 1970 and 1978.

Scholastic Aptitude Test Scores for California and the Nation 1971-72 Through 1985-86

Category		71-72	72-73	73-74	74-75	75-76	76-77	77-78	78-79	79-80	80-81	81-82	82-83	83-84	84-85	85-86
Math																
California	Total	493	485	484	473	470	470	466	473	472	475	474	474	476	480	481
	boys	518	511	509	501	500	500	496	502	500	503	503	503	502	506	508
	girls	467	460	460	446	443	443	440	447	446	449	448	448	453	456	456
Nation	Total	484	481	480	472	472	470	468	467	466	466	467	468	471	475	475
	boys	505	502	501	495	497	497	494	493	491	492	493	493	495	499	501
	girls	461	460	459	449	446	445	444	443	443	443	443	445	449	452	451
Verbal																
California	Total	464	452	450	435	430	427	427	428	424	426	425	421	421	424	423
	boys	446	456	454	440	434	431	432	432	429	434	431	426	427	431	428
	girls	462	448	446	431	426	424	423	424	420	419	420	416	415	419	418
Nation	Total	452	445	444	434	431	429	429	427	424	424	426	425	426	431	431
	boys	454	446	447	437	433	431	433	431	428	430	431	430	433	437	437
	girls	452	443	442	431	430	426	425	423	420	418	421	420	420	425	426

APPENDIX B

Percent and Scores of Third and Sixth Grade Students, by Parent Occupation (Socioeconomic Status) Categories, 1985-86

Parent occupation	% grade 3 students	Reading	Writ. Lang.	Math	% grade 6 students	Reading	Writ. lang.	Math
Professional	13	348	345	338	14	322	324	326
Semiprofessional	19	309	313	305	17	289	296	292
Skilled/semiskilled	38	275	282	279	38	255	268	263
Unskilled	25	238	245	249	24	219	235	232
Unknown	4	240	246	248	4	222	237	235

Percent and Scores of Eighth and Twelfth Grade Students, by Parent Education (Socioeconomic Status) Categories, 1985-86

Parent education	% Gr. 8 students	Reading	Writ. Exp.	Math	HSS	Science	% Grade 12 students	Reading	Writ.	Math	Spelling
Adv. Degree	12	313	314	323	320	312	17	69.9	71.2	76.7	74.6
College graduate	23	272	276	282	275	277	24	66.0	67.0	72.2	72.2
Some college	21	258	260	263	257	264	23	64.6	64.9	69.7	70.9
High school graduate	25	218	224	226	214	229	21	58.4	58.7	63.7	67.5
Not high school graduate	16	182	194	199	179	193	13	52.4	53.2	59.8	64.7

Percent and Scores of Third, Sixth, Eighth, and Twelfth Grade Students, by English Language Fluency Group, 1985-86

Language fluency	% of students	Reading	Writ.	Math	Spelling	History-Social Science	Science
Grade 3							
English only	68	291	296	290			
Fluent Engl. & 2nd Lang.	16	269	275	279			
Limited Engl. & 2nd Lang.	9	215	221	242			
Non-English Speaking	7						
Grade 6							
English only	68	273	282	277			
Fluent Engl. & 2nd Lang.	22	244	257	258			
Limited Engl. & 2nd Lang.	7	182	200	212			
Non-English Speaking	3						
Grade 8							
English only	74	256	259	262		256	263
Fluent Engl. & 2nd Lang.	19	220	231	237		219	226
Limited Engl. & 2nd Lang.	5	136	153	179		139	153
Non-English Speaking	2						
Grade 12							
English only	83	64.6	65.1	69.7	71.0		
Fluent Engl. & 2nd Lang.	12	57.1	58.7	66.1	68.4		
Limited Engl. & 2nd Lang.	5	42.9	44.9	56.7	59.9		

Percent and Scores of Eighth and Twelfth Grade Students, by Ethnic Background Group, 1985-86

Ethnic Background Grade 8	% of students	Reading	Writ. Exp.	Math	Spelling	H-SS	Science
Amer. Ind./Alaskan Native	3	206	208	216		207	225
Asian	7	257	271	306		263	257
Pacific Islander	1	216	225	234		218	226
Filipino	3	268	278	271		257	260
Hispanic	26	199	207	208		197	207
Black-not of Hispanic origin	9	196	202	194		190	200
White-not of Hispanic origin	50	275	276	282		277	283
Grade 12							
Amer. Ind./Alaskan Native	2	57.5	57.7	61.8	65.7		
Asian	8	58.6	61.9	75.1	71.5		
Pacific Islander	1	55.9	56.5	63.4	68.5		
Filipino	3	60.7	62.6	68.4	76.8		
Hispanic	19	55.5	55.9	60.8	66.1		
Black-not of Hispanic origin	8	54.9	55.2	57.4	66.4		
White-not of Hispanic origin	57	67.6	68.1	72.7	72.0		

Percent of Twelfth Grade Students, by Number of Years of Various Courses Completed, 1985-86

Years	English	Math	Science	H-SS	For. Lang.	Art, Mu.	Comp.Stud.
None	0	0	0	0	20	29	45
1/2 yr.	0	0	1	0	5	8	21
1 yr.	0	2	21	4	14	20	20
1 1/2 yr.	0	2	5	2	2	4	3
2 yr.	1	18	32	13	30	12	5
2 1/2 yr.	1	6	5	6	2	2	1
3 yr.	10	28	20	34	14	7	1
3 1/2 yr.	6	6	3	10	1	2	0
4 yr.	71	32	10	25	6	8	0
4 1/2 yr.	5	1	1	2	0	1	0
5+ years	6	3	2	2	1	3	0

Percent of Twelfth Grade Students, by Number of Writing Assignments Written Each Week, 1985-86

No. of assignments	% of students
None	3
1	10
2	13
3	18
4-5	27
6-10	19
11 or more	9

Percent and Scores of Sixth, Eighth, and Twelfth Grade Students, by Time Spent Watching TV, 1985-86

Hours	% of students	% correct scores					
		Reading	Writ.	Math	Spelling	H-SS	Science
Grade 6							
0	8	76.9	79.5	69.0			
0-1/2	23	75.4	78.2	68.0			
1/2-1	33	74.7	77.7	67.1			
1-2	21	75.3	78.1	67.8			
2-3	8	74.8	77.7	67.0			
3-4	3	73.9	77.0	65.7			
4-5	1	72.6	76.1	64.3			
5+	1	68.5	73.1	60.9			
Grade 8							
0	2	68.1	63.6	59.0		58.2	61.8
0-1/2	4	67.7	64.0	59.1		57.9	61.6
1/2-1	9	67.4	63.5	58.7		57.4	61.0
1-2	19	67.6	63.7	58.7		57.4	60.9
2-3	22	66.4	62.5	57.0		56.1	59.7
3-4	17	65.0	61.0	55.2		54.7	58.7
4-5	11	63.6	59.5	53.4		53.3	57.2
5+	17	58.3	54.6	48.8		49.3	53.7
Grade 12							
0	--	--	--	--	--		
0-1/2	13	68.0	69.5	74.5	73.8		
1/2-1	17	65.3	66.5	72.0	71.9		
1-2	24	63.7	64.5	70.3	71.0		
2-3	17	61.5	62.0	67.2	69.3		
3-4	9	59.6	59.8	64.5	68.1		
4-5	5	58.6	58.5	62.8	67.4		
5+	7	56.6	56.6	61.1	66.1		

Percent and Scores of Sixth, Eighth, and Twelfth Grade Students, by Time Spent on Homework

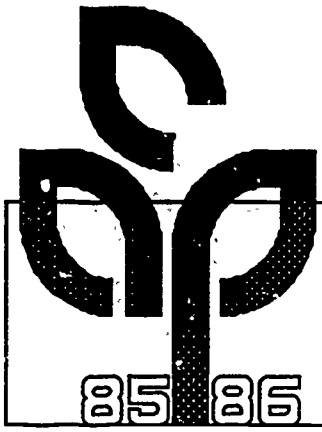
Hours	% of students	% correct scores				
		Reading	Writ.	Math	H-SS	Science
Grade 6						
None	2	65.4	71.0	59.5		
< 1 hr.	33	72.2	75.8	64.9		
1-<2 hrs.	50	74.1	77.2	65.9		
2 hrs. or more	15	73.4	76.6	65.5		
Grade 8						
None	3	54.5	49.9	46.4	49.6	55.3
< 1 hr.	31	62.5	58.3	53.4	55.8	61.3
1-<2 hrs.	48	65.9	62.0	56.1	58.3	63.3
2 hrs. or more	18	68.5	65.0	59.4	60.8	64.8
Grade 12						
None	4					
< 1 hr.	26					
1-<2 hrs.	41					
2 hrs. or more	28					

Percent and Scores of Sixth, Eighth, and Twelfth Grade Students, by Time Spent Reading for Pleasure, 1985-86

Hours	% of students	% correct scores					
		Reading	Writ.	Math	Spelling	H-SS	Science
Grade 6							
0	8	66.5	71.7	59.9			
0-1/2	23	71.8	75.5	64.8			
1/2-1	33	73.4	76.6	65.6			
1-2	21	75.2	78.0	66.9			
2-3	8	76.8	79.1	67.9			
3-4	3	76.1	78.8	67.2			
4-5	1	74.8	77.6	65.1			
5+	1	76.3	78.7	66.1			
Grade 8							
0	12	57.1	53.1	49.1		48.6	53.7
0-1/2	30	63.1	59.3	54.6		53.5	57.8
1/2-1	30	66.0	62.2	56.4		55.7	59.3
1-2	17	67.9	64.1	58.0		57.4	60.4
2-3	7	69.9	65.5	58.5		58.7	61.9
3-4	3	70.2	65.6	58.0		59.0	61.7
4-5	1	71.5	66.7	58.5		59.7	62.3
5+	1	70.0	65.2	57.7		59.2	62.3
Grade 12							
0	--	--	--	--	--		
0-1/2	32	63.0	64.0	70.4	70.1		
1/2-1	30	63.2	64.1	69.7	70.6		
1-2	17	63.0	63.6	68.0	70.9		
2-3	6	62.9	63.1	66.1	70.6		
3-4	2	63.1	62.7	65.2	70.2		
4-5	1	62.5	62.5	64.5	70.1		
5+	2	65.0	64.2	66.2	71.4		

Percent and Scores of Sixth and Eighth Grade Students, by Number of Writing Assignments During Last Six Weeks, 1985-86

No. of assignments	% of students	% correct scores				
		Reading	Writ.	Math	H-SS	Science
Grade 6						
None	3	61.2	67.1	54.4		
1	5	67.3	71.7	59.7		
2	8	69.0	73.1	61.2		
3	10	70.3	74.3	62.6		
4-5	19	72.4	75.8	64.3		
6-10	23	75.3	78.2	67.4		
11 or more	32	76.0	78.8	68.3		
Grade 8						
None	5	55.4	51.8	46.5	49.6	55.0
1	8	60.8	57.4	51.9	54.6	59.7
2	10	62.5	59.4	53.7	56.2	61.2
3	12	63.3	60.2	54.3	56.7	61.8
4-5	20	65.2	61.8	56.2	58.4	63.1
6-10	18	67.8	64.3	59.2	61.1	65.5
11 or more	26	67.6	64.1	59.4	61.0	65.4



English Language Arts

APPENDIX C

Reading Assessment Advisory Committee

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Reading Scores of California Third Grade Students on the *Survey of Basic Skills: Grade 3*, 1979-80 Through 1985-86

Skill area	Number of questions	Average percent correct score							Change in score						Total
		79-80	80-81	81-82	82-83	83-84	84-85	85-86	79-80 to 80-81	80-81 to 81-82	81-82 to 82-83	82-83 to 83-84	83-84 to 84-85	84-85 to 85-86	79-80 to 85-86
TOTAL READING	270	70.0	70.6	71.5	72.7	73.7	74.8	76.0	+0.6	+0.9	+1.2	+1.0	+1.1	+1.2	+6.0
Word Identification	60	76.5	77.3	78.2	79.4	80.3	81.5	82.8	+0.8	+0.9	+1.2	+0.9	+1.2	+1.3	+6.3
Phonics	30	78.9	79.6	80.3	81.2	81.7	82.5	83.5	+0.7	+0.7	+0.9	+0.5	+0.8	+1.0	+4.6
Vowels	15	77.7	78.4	79.0	80.0	80.7	81.4	82.3	+0.7	+0.6	+1.0	+0.7	+0.7	+0.9	+4.6
Consonants	15	80.1	80.8	81.6	82.3	82.8	83.6	84.6	+0.7	+0.8	+0.7	+0.5	+0.8	+1.0	+4.5
Structural analysis	30	74.2	75.0	76.2	77.6	78.9	80.5	82.0	+0.8	+1.2	+1.4	+1.3	+1.6	+1.5	+7.8
Prefixes, suffixes, roots	18	69.9	69.7	71.0	72.4	73.7	75.4	77.4	+0.7	+1.3	+1.4	+1.3	+1.7	+2.0	+8.4
Contractions and compounds	12	82.1	82.8	84.0	85.4	86.8	87.9	89.1	+0.7	+1.2	+1.4	+1.4	+1.1	+1.2	+7.0
Vocabulary	30	62.5	62.8	64.0	64.9	66.4	68.0	69.4	+0.3	+1.2	+0.9	+1.5	+1.6	+1.4	+6.9
Recognizing word meanings	16	68.5	68.8	70.1	71.2	72.4	74.1	75.1	+0.3	+1.3	+1.1	+1.2	+1.7	+1.0	+6.6
Using context, multiple-meaning words	14	55.7	55.9	57.1	57.6	59.4	60.9	62.8	+0.2	+1.2	+0.5	+1.8	+1.5	+1.9	+7.1
Comprehension	150	65.8	66.2	67.0	68.3	69.2	70.4	71.6	+0.4	+0.8	+1.3	+0.9	+1.2	+1.2	+5.8
Literal	74	65.2	65.7	66.4	67.8	68.6	69.8	71.0	+0.5	+0.7	+1.4	+0.8	+1.2	+1.2	+5.8
Details	37	63.5	64.0	64.6	65.9	66.7	67.9	69.1	+0.5	+0.6	+1.3	+0.8	+1.2	+1.2	+5.6
single sentence	20	63.7	64.1	64.9	66.3	67.1	68.4	69.7	+0.4	+0.8	+1.4	+0.8	+1.3	+1.3	+6.0
two or three sentences	17	63.1	63.9	64.3	65.5	66.3	67.3	68.4	+0.8	+0.4	+1.2	+0.8	+1.0	+1.1	+5.3
Pronoun references	18	70.9	71.1	72.0	73.3	74.5	75.4	76.6	+0.2	+0.9	+1.3	+1.2	+0.9	+1.2	+5.7
Sequence	19	63.2	63.9	64.6	66.1	66.6	68.2	69.3	+0.7	+0.7	+1.5	+0.5	+1.6	+1.1	+6.1
Inferential	76	66.3	66.8	67.5	68.7	69.9	71.0	72.2	+0.5	+0.7	+1.2	+1.2	+1.1	+1.2	+5.9
Main idea	19	69.5	70.1	71.3	72.5	73.8	75.2	76.5	+0.6	+1.2	+1.2	+1.3	+1.4	+1.3	+7.0
Cause and effect	20	66.8	67.1	67.9	69.3	70.3	71.2	72.6	+0.3	+0.8	+1.4	+1.0	+0.9	+1.4	+5.8
Drawing conclusions	37	64.3	64.9	65.4	66.5	67.7	68.8	69.8	+0.6	+0.5	+1.1	+1.2	+1.1	+1.0	+5.5
about characters	15	70.5	71.0	72.1	73.2	74.3	75.3	76.3	+0.5	+1.1	+1.1	+1.1	+1.0	+1.0	+5.8
from details	12	56.5	56.9	57.0	58.0	59.4	60.0	61.0	+0.4	+0.1	+1.0	+1.4	+0.6	+1.0	+4.5
from overall meaning	10	64.4	65.2	65.4	66.8	67.7	69.6	70.4	+0.8	+0.2	+1.4	+0.9	+1.9	+0.8	+6.0
Study-locational	30	85.9	86.7	87.8	88.9	89.8	90.6	91.2	+0.8	+1.1	+1.1	+0.9	+0.8	+0.6	+5.3
Alphabetizing	15	82.2	83.1	84.0	85.3	86.0	86.9	87.5	+0.9	+0.9	+1.3	+0.7	+0.9	+0.6	+5.3
Table of contents	15	89.5	90.3	91.6	92.5	93.5	94.3	94.9	+0.8	+1.3	+0.9	+1.0	+0.8	+0.6	+5.4

Reading Scores of California Sixth Grade Students on the *Survey of Basic Skills: Grade 6*, 1981-82 Through 1985-86

Skill area	Number of questions	Average percent correct score					Change in score				Total change, 81-82 to 85-86
		81-82	82-83	83-84	84-85	85-86	81-82 to 82-83	82-83 to 83-84	83-84 to 84-85	84-85 to 85-86	
TOTAL READING	430	71.5	71.3	70.6	71.4	72.6	-0.2	-0.7	+0.8	+1.2	+1.1
Vocabulary	70	70.1	69.9	69.5	70.2	71.5	-0.2	-0.4	+0.7	+1.3	+1.4
Prefixes, roots, and suffixes	16	67.0	66.8	66.8	67.6	68.6	-0.2	-0-	+0.8	+1.0	+1.6
Recognizing word meanings	37	67.7	67.7	67.1	67.9	69.4	-0-	-0.6	+0.8	+1.5	+1.7
Using context with multiple-meaning words	17	78.1	77.6	77.3	77.7	78.8	-0.5	-0.3	+0.4	+1.1	+0.7
Comprehension	330	71.2	71.0	70.1	70.9	72.3	-0.2	-0.9	+0.8	+1.4	+1.1
Literal	62	76.7	76.4	75.5	76.6	77.9	-0.3	-0.9	+1.1	+1.3	+1.2
Details	31	80.1	79.9	78.8	80.0	81.4	-0.2	-1.1	+1.2	+1.4	+1.3
–from single sentence	14	80.2	79.8	78.9	80.3	82.0	-0.4	-0.9	+1.4	+1.7	+1.8
–from two or three sentences	17	80.0	79.9	78.7	79.8	81.0	-0.1	-1.2	+1.1	+1.2	+1.0
Pronoun references	16	74.3	73.9	72.9	73.8	74.8	-0.4	-1.0	+0.9	+1.0	+0.5
Sequence	15	72.4	72.0	71.5	72.5	73.8	-0.4	-0.5	+1.0	+1.3	+1.4
Inferential	127	67.3	67.2	66.3	67.2	68.6	-0.1	-0.9	+0.9	+1.4	+1.3
Main idea	16	73.4	73.6	72.9	74.1	75.5	+0.2	-0.7	+1.2	+1.4	+2.1
Cause and effect	15	75.6	75.5	74.6	75.2	76.1	-0.1	-0.9	+0.6	+0.9	+0.5
Following organization	16	58.0	58.2	57.9	59.1	60.4	+0.2	-0.3	+1.2	+1.3	+2.4
Putting information together	15	62.5	62.1	60.9	62.2	63.7	-0.4	-1.2	+1.3	+1.5	+1.2
Predicting outcomes	18	69.3	68.7	68.0	68.7	70.0	-0.6	-0.7	+0.7	+1.3	+0.7
Making comparisons and contrasts	17	60.6	60.7	59.9	60.4	61.7	+0.1	-0.8	+0.5	+1.3	+1.1
Drawing conclusions from details	16	65.1	65.2	64.2	65.0	66.2	+0.1	-1.0	+0.8	+1.2	+1.1
Drawing conclusions from overall meaning	14	75.3	74.8	73.6	74.3	76.1	-0.5	-1.2	+0.7	+1.8	+0.8
Interpretive	79	74.9	74.6	73.5	73.9	75.1	-0.3	-1.1	+0.4	+1.2	+0.2
Analyzing characters	18	75.6	75.4	74.4	74.8	76.2	-0.2	-1.0	+0.4	+1.4	+0.6
Understanding setting	12	78.4	77.9	77.0	77.3	78.3	-0.5	-0.9	+0.3	+1.0	-0.1
Summarizing plot	13	73.4	73.2	72.0	72.4	73.1	-0.2	-1.2	+0.4	+0.7	-0.3
Understanding dialogue	12	77.2	77.3	76.0	76.2	77.5	+0.1	-1.3	+0.2	+1.3	+0.3
Sensing mood	12	67.1	66.4	65.3	65.7	67.5	-0.7	-1.1	+0.4	+1.8	+0.4
Understanding figurative language	12	77.4	77.1	75.8	76.6	77.9	-0.3	-1.3	+0.8	+1.3	+0.5
Critical/applicative	62	68.7	68.8	68.1	69.2	70.8	+0.1	-0.7	+1.1	+1.6	+2.1
Detecting author and author's attitude	12	66.1	66.2	65.1	66.5	68.1	+0.1	-1.1	+1.4	+1.6	+2.0
Detecting author's purpose	19	72.7	72.7	72.0	72.7	74.5	-0-	-0.7	+0.7	+1.8	+1.8
Separating fact from opinion	16	66.8	67.1	67.3	69.3	71.3	+0.3	+0.2	+2.0	+2.0	+4.5
Applications to a different context	15	67.9	67.6	66.5	66.9	67.9	-0.3	-1.1	+0.4	+1.0	-0-
Study-locational skills	30	78.1	78.1	77.9	79.0	84.6	-0-	-0.2	+1.1	+5.6	+6.5
Reference materials and parts of a book	15	81.8	81.5	81.7	82.7	83.6	-0.3	+0.2	+1.0	+1.1	+2.0
Maps, graphs, and charts	15	74.2	74.6	74.2	75.4	89.3	0.4	-0.4	+1.2	+13.9	+15.1
READING IN THE CONTENT AREAS											
Vocabulary--word meanings	37	67.7	67.7	67.1	67.9	69.4	-0-	-0.6	+0.8	+1.5	+1.7
In reading and literature	13	71.2	71.0	70.3	71.2	79.7	-0.2	-0.7	+0.9	+8.5	+8.5
In science	11	71.1	71.3	70.7	71.4	72.2	0.2	-0.6	+0.7	+0.8	+1.1
In social studies	13	61.3	61.4	60.9	61.8	74.7	0.1	-0.5	+0.9	+12.9	+13.4
Comprehension of literature passages	117	74.3	74.0	72.9	73.4	74.5	-0.3	-1.1	+0.5	+1.1	+0.2
Literal	17	79.5	78.7	77.7	78.6	71.1	-0.8	-1.0	+0.9	-7.5	-8.4
Inferential	29	72.0	71.9	70.8	71.2	78.1	-0.1	-1.1	+0.4	+6.9	+6.1
Interpretive	61	74.7	74.4	73.3	73.6	66.8	-0.3	-1.1	+0.3	-6.8	-7.9
Critical/applicative	10	69.9	69.8	68.8	69.5	71.1	-0.1	-1.0	+0.7	+1.6	+1.2
Comprehension of science passages	103	68.0	68.0	67.3	68.4	69.9	-0-	-0.7	+1.1	+1.5	+1.9
Literal	17	76.5	76.6	75.7	76.8	78.1	0.1	-0.9	+1.1	+1.3	+1.6
Inferential	58	65.4	65.2	64.5	65.5	66.8	-0.2	-0.7	+1.0	+1.3	+1.4
Critical/applicative	28	68.4	68.5	68.1	69.2	71.1	0.1	-0.4	+1.1	+1.9	+2.7
Comprehension of social studies passages	107	70.8	70.7	69.8	70.9	72.9	-0.1	-0.9	+1.1	+2.0	+2.1
Literal	28	75.2	75.0	74.0	75.3	76.7	-0.2	-1.0	+1.3	+1.4	+1.5
Inferential	40	66.7	66.6	65.8	66.8	68.3	-0.1	-0.8	+1.0	+1.5	+1.6
Interpretive	15	77.0	77.0	75.6	76.4	78.0	-0-	-1.4	+0.8	+1.6	+1.0
Critical/applicative	24	68.7	68.7	67.9	69.0	70.5	-0-	-0.8	+1.1	+1.5	+1.8

Reading Scores of California Eighth Grade Students on the *Survey of Academic Skills: Grade 8*, 1983-84 Through 1985-86

Skill area	Number of questions	Average percent correct score			Change in score		Total change
		83-84	84-85	85-86	83-84 to 84-85	84-85 to 85-86	83-84 to 85-86
TOTAL READING	**396**	**66.2**	**64.2**	**64.7**	**-2.0**	**+0.5**	**-1.5**
Vocabulary	**83**	**67.1**	**65.3**	**66.0**	**-1.8**	**+0.7**	**-1.1**
Prefixes, roots, and suffixes	15	62.2	61.7	61.8	-0.5	+0.1	-0.4
Word meaning	51	66.1	64.6	64.9	-1.5	+0.3	-1.2
Using context	17	74.0	70.4	72.9	-3.6	+2.5	-1.1
Comprehension	**277**	**66.4**	**64.3**	**64.7**	**-2.1**	**+0.4**	**-1.7**
Literal	44	72.2	68.8	69.3	-3.4	+0.5	-2.9
Details	14	75.0	71.5	71.6	-3.5	+0.1	-3.4
Pronoun reference	15	69.7	66.2	67.9	-3.5	+1.7	-1.8
Sequence	15	72.7	69.0	68.6	-3.7	-0.4	-4.1
Inferential	96	66.5	64.8	65.4	-1.7	+0.6	-1.1
Main idea	16	69.3	67.3	67.2	-2.0	-0.1	-2.1
Cause and effect	16	70.0	66.7	67.3	-3.3	+0.6	-2.7
Following organization	16	69.0	66.8	67.7	-2.2	+0.9	-1.3
Predicting outcome	15	69.4	67.5	68.0	-1.9	+0.5	-1.4
Compare and contrast	17	58.7	56.4	57.2	-2.3	+0.8	-1.5
Drawing conclusions	16	65.8	64.2	65.3	-1.6	+1.1	-0.5
Interpretive	62	65.6	63.5	64.0	-2.1	+0.5	-1.6
Analyzing character	15	70.0	67.2	67.0	-2.8	-0.2	-3.0
Understanding plot, setting, dialogue	16	68.8	65.4	66.3	-3.4	+0.9	-2.5
Sensing mood	15	66.6	65.1	65.3	-1.5	+0.2	-1.3
Recognizing literary type	16	57.1	56.5	57.7	-0.6	+1.2	+0.6
Critical/applicative	75	63.2	61.6	61.8	-1.6	+0.2	-1.4
Author, author's attitude, author's purpose	14	65.5	63.6	62.9	-1.9	-0.7	-2.6
Separating fact, opinion, hypothesis	15	63.7	62.0	62.4	-1.7	+0.4	-1.3
Justifying inference	15	56.0	54.3	54.6	-1.7	+0.3	-1.4
Formulating critical questions	15	59.6	58.8	59.0	-0.8	+0.2	-0.6
Applications to another context	16	71.0	68.7	69.6	-2.3	+0.9	-1.4
Study-locational skills	**36**	**62.7**	**61.5**	**61.9**	**-1.2**	**+0.4**	**-0.8**
Reference and dictionary skills	16	62.0	60.5	61.0	-1.5	+0.5	-1.0
Graphs and charts	20	63.2	62.3	62.6	-0.9	+0.3	-0.6
TOTAL READING IN THE CONTENT AREAS	**324**	**66.3**	**64.3**	**64.3**	**-2.0**	**+0.5**	**-1.5**
Word meanings	**51**	**66.1**	**64.6**	**64.9**	**-1.5**	**+0.3**	**-1.2**
In reading and literature	14	66.5	64.4	64.9	-2.1	+0.5	-1.6
In science	17	63.9	62.6	63.3	-1.3	+0.7	-0.6
In social studies	20	67.7	66.5	66.3	-1.2	-0.2	-1.4
Comprehension of literature passages	**88**	**67.1**	**64.8**	**65.2**	**-2.3**	**+0.4**	**-1.9**
Literal	13	78.6	74.9	74.4	-3.7	-0.5	-4.2
Inferential	16	70.7	68.2	68.9	-2.5	+0.7	-1.8
Interpretive	44	64.8	62.8	63.2	-2.0	+0.4	-1.6
Critical/applicative	15	60.3	58.6	59.2	-1.7	+0.6	-1.1
Comprehension of science passages	**89**	**63.2**	**61.5**	**62.2**	**-1.7**	**+0.7**	**-1.0**
Literal	16	63.4	59.9	61.1	-3.5	+1.2	-2.3
Inferential	44	64.8	63.5	64.1	-1.3	+0.6	-0.7
Interpretive	29	60.6	59.1	59.4	-1.5	+0.3	-1.2
Comprehension of social studies passages	**96**	**68.6**	**66.4**	**66.8**	**-2.2**	**+0.4**	**-1.8**
Literal	15	76.9	73.2	73.7	-3.7	+0.5	-3.2
Inferential	34	66.8	64.9	65.5	-1.9	+0.6	-1.3
Interpretive	16	67.8	65.3	66.0	-2.5	+0.7	-1.8
Critical/applicative	31	67.1	65.3	65.3	-1.8	-0-	-1.8

Reading Scores of California Twelfth Grade Students on the *Survey of Basic Skills: Grade 12*, 1975-76 Through 1985-86

Skill area	No. of questions	Average percent correct score											Change in average percent correct score										Total change, 75-76 to 85-86
		75-76	76-77	77-78	78-79	79-80	80-81	81-82	82-83	83-84	84-85	85-86	75-76 to 76-77	76-77 to 77-78	77-78 to 78-79	78-79 to 79-80	79-80 to 80-81	80-81 to 81-82	81-82 to 82-83	82-83 to 83-84	83-84 to 84-85	84-85 to 85-86	
TOTAL READING	**141**	**64.1**	**63.6**	**63.3**	**63.2**	**63.1**	**63.4**	**63.2**	**63.1**	**62.2**	**62.8**	**62.7**	**-0.5**	**-0.3**	**-0.1**	**-0.1**	**+0.3**	**-0.2**	**-0.1**	**-0.9**	**+0.6**	**-0.1**	**-1.4**
Vocabulary	31	61.3	60.9	60.5	60.2	60.0	60.2	60.1	60.0	59.5	59.6	59.5	-0.4	-0.4	-0.3	-0.2	+0.2	-0.1	-0.1	-0.5	+0.1	-0.1	-1.8
Comprehension	97	64.5	63.9	63.7	63.7	63.5	63.8	63.5	63.4	62.3	63.0	62.7	-0.6	-0.2	-0-	-0.2	+0.3	-0.3	-0.1	-1.1	+0.7	-0.3	-1.8
Literal	47	69.2	68.9	68.5	68.6	68.5	68.8	68.6	68.3	67.0	67.8	67.4	-0.3	-0.4	+0.1	-0.1	+0.3	-0.2	-0.3	-1.3	+0.8	-0.4	-1.8
Interpretive/critical	50	60.1	59.3	59.2	59.0	58.9	59.1	58.8	58.7	57.9	58.5	58.3	-0.8	-0.1	-0.2	-0.1	+0.2	-0.3	-0.1	-0.8	+0.6	-0.2	-1.8
Study/locational	13	68.4	67.2	67.3	67.4	67.4	68.4	68.2	68.3	68.1	68.8	69.2	-1.2	+0.1	+0.1	-0-	+1.0	-0.2	+0.1	-0.2	+0.7	+0.4	+0.8

Written Language Scores of California Third Grade Students on the *Survey of Basic Skills: Grade 3*, 1979-80 Through 1985-86

Skill area	Number of questions	Average percent correct score							Change in score						Total change
		79-80	80-81	81-82	82-83	83-84	84-85	85-86	79-80 to 80-81	80-81 to 81-82	81-82 to 82-83	82-83 to 83-84	83-84 to 84-85	84-85 to 85-86	79-80 to 85-86
WRITTEN LANGUAGE, TOTAL	390	74.9	75.4	76.6	77.7	78.8	80.0	81.1	+0.6	+1.2	+1.1	+1.1	+1.2	+1.1	+6.3
WRITING PROCESS SKILLS															
Paragraphs	30	69.6	70.0	71.3	72.5	74.1	75.4	76.6	+0.4	+1.3	+1.2	+1.6	+1.3	+1.2	+7.0
Topic sentence	15	68.4	68.8	70.1	71.3	72.4	73.7	74.9	+0.4	+1.3	+1.2	+1.1	+1.3	+1.2	+6.5
Details and sequence	15	70.9	71.3	72.5	73.7	75.8	77.0	78.3	+0.4	+1.2	+1.2	+2.1	+1.2	+1.3	+7.4
Sentence recognition	75	78.4	79.1	80.5	81.8	82.8	84.2	85.3	+0.7	+1.4	+1.3	+1.0	+1.4	+1.1	+6.9
Statements and questions	15	74.1	74.9	76.1	77.6	78.7	80.3	81.6	+0.8	+1.2	+1.5	+1.1	+1.6	+1.3	+7.5
Complete sentences	60	79.5	80.2	81.7	82.8	83.8	85.2	86.2	+0.7	+1.5	+1.1	+1.0	+1.4	+1.0	+6.7
Supplying subjects	30	78.8	79.5	80.8	83.6	84.7	85.9	87.0	+0.7	+1.3	+2.8	+1.1	+1.2	+1.1	+8.2
Supplying verbs	30	80.3	80.9	82.5	82.0	82.9	84.4	85.3	+0.6	+1.6	-0.5	+0.9	+1.5	+0.9	+5.0
Language choices	30	66.1	67.0	68.6	69.9	70.8	72.4	74.3	+0.9	+1.6	+1.3	+0.9	+1.6	+1.9	+8.2
Sensory words	15	72.1	73.0	74.1	75.4	76.5	77.5	79.0	+0.9	+1.1	+1.3	+1.1	+1.0	+1.5	+6.9
Specific words	15	60.2	61.0	63.1	64.4	65.1	67.4	69.6	+0.8	+2.1	+1.3	+0.7	+2.3	+2.2	+9.4
SUPPORTING SKILLS															
Standard usage	60	74.2	74.4	75.1	76.0	76.7	77.6	78.5	+0.2	+0.7	+0.9	+0.7	+0.9	+0.9	+4.3
Irregular verbs	15	76.7	76.6	77.3	78.1	78.7	79.7	80.6	-0.1	+0.7	+0.8	+0.6	+1.0	+0.9	+3.9
Pronouns	15	73.5	73.8	74.4	75.3	75.4	76.5	77.1	+0.3	+0.6	+0.9	+0.1	+1.1	+0.6	+3.6
Subject-verb agreement	16	69.3	69.5	70.4	71.1	72.6	73.2	74.3	+0.2	+0.9	+0.7	+1.5	+0.6	+1.1	+5.0
Noun determiners	14	78.0	78.5	78.9	80.0	80.7	81.4	82.6	+0.5	+0.4	+1.1	+0.7	+0.7	+1.2	+4.6
Word forms	66	74.9	75.2	76.0	77.1	78.3	79.5	80.9	+0.3	+0.8	+1.1	+1.2	+1.2	+1.4	+6.0
Prefixes	14	79.1	79.4	79.9	80.9	82.1	83.2	84.6	+0.3	+0.5	+1.0	+1.2	+1.1	+1.4	+5.5
Inflectional suffixes	12	76.3	76.6	78.0	79.1	80.3	81.2	82.3	+0.3	+1.4	+1.1	+1.2	+0.9	+1.1	+6.0
Derivational suffixes	11	76.3	76.8	77.3	78.1	78.9	79.8	81.6	+0.5	+0.5	+0.8	+0.8	+0.9	+1.8	+5.3
Irregular noun plurals	14	65.1	64.8	65.2	65.7	66.1	67.8	69.0	-0.3	+0.4	+0.5	+0.4	+1.7	+1 2	+3.9
Contractions	15	77.8	78.9	80.0	81.9	83.9	85.7	86.9	+1.1	+1.1	+1.9	+2.0	+1.8	+1.2	+9.1
Spelling	69	73.0	73.5	74.6	75.8	76.7	77.6	78.5	+0.5	+1.1	+1.2	+0.9	+0.9	+0.9	+5.5
Predictables	39	80.4	80.7	81.7	82.8	83.7	84.5	85.2	+0.3	+1.0	+1.1	+0.9	+0.8	+0.7	+4.8
Words with suffixes	16	55.5	56.3	57.5	58.9	60.1	61.2	62.0	+0.8	+1.2	+1.4	+1.2	+1.1	+0.8	+6.5
Demons and homophones	14	72.4	73.2	74.3	75.7	76.3	77.3	78.5	+0.8	+1.1	+1.4	+0.6	+1.0	+1.2	+6.1
Punctuation	30	72.0	73.3	74.9	76.8	78.6	80.1	81.5	+1.3	+1.6	+1.9	+1.8	+1.5	+1.4	+9.5
Periods and questions	10	77.8	79.0	80.8	82.6	83.6	85.1	86.1	+1.2	+1.8	+1.8	+1.0	+1.5	+1.0	+8.3
Commas	10	62.4	63.7	65.2	67.7	69.9	71.6	73.9	+1.3	+1.5	+2.5	+2.2	+1.7	+2.3	+11.5
Apostrophes	10	75.7	77.1	78.7	80.1	82.0	83.4	84.4	+1.4	+1.6	+1.4	+1.9	+1.4	+1.0	+8.7
Capitalization	30	88.1	89.2	90.1	91.1	92.0	92.9	93.6	+1.1	+0.9	+1.0	+0.9	+0.9	+0.7	+5.5
Persons	10	90.9	91.6	92.4	93.2	93.7	94.3	94.9	+0.7	+0.8	+0.8	+0.5	+0.6	+0.6	+4.0
Places	10	87.3	88.5	89.4	90.4	91.5	92.5	93.4	+1.2	+0.9	+1.0	+1.1	+1.0	+0.9	+6.1
Days/months	10	86.0	87.5	88.5	89.7	91.0	91.8	92.4	+1.5	+1.0	+1.2	+1.3	+0.8	+0.6	+6.4

Written Language Scores of California Sixth Grade Students on the *Survey of Basic Skills: Grade 6*, 1981-82 Through 1985-86

Skill area	Number of questions	Average percent correct score					Change in average percent correct score				Total change
		81-82	82-83	83-84	84-85	85-86	81-82 to 82-83	82-83 to 83-84	83-84 to 84-85	84-85 to 85-86	81-82 to 85-86
WRITTEN LANGUAGE, TOTAL	**342**	**73.3**	**73.7**	**74.0**	**75.0**	**76.1**	**+0.4**	**+0.3**	**+1.0**	**+1.1**	**+2.8**
Writing Process Skills	**182**	**72.6**	**73.0**	**73.5**	**74.6**	**76.1**	**+0.4**	**+0.5**	**+1.1**	**+1.5**	**+3.5**
Judging student writing	**22**	**71.4**	**71.7**	**71.8**	**72.9**	**74.1**	**+0.3**	**+0.1**	**+1.1**	**+1.2**	**+2.7**
Paragraphs	**40**	**76.1**	**76.3**	**76.1**	**77.3**	**78.6**	**+0.2**	**-0.2**	**+1.2**	**+1.3**	**+2.5**
Topic sentences	10	74.2	74.7	74.1	75.2	76.6	+0.5	-0.6	+1.1	+1.4	+2.4
Details and sequence	10	77.0	77.6	77.5	78.8	80.5	+0.6	-0.1	+1.3	+1.7	+3.5
Outlines for organization	10	71.7	72.1	72.1	73.6	75.1	+0.4	+0.0	+1.5	+1.5	+3.4
Consistency of verb and pronoun	10	81.6	81.0	80.8	81.5	82.2	-0.6	-0.2	+0.7	+0.7	+0.6
Sentence combining	**50**	**66.8**	**67.9**	**69.6**	**71.1**	**73.2**	**+1.1**	**+1.7**	**+1.5**	**+2.1**	**+6.4**
Simple sentences with modification	13	52.0	53.6	55.0	56.5	59.0	+1.6	+1.4	+1.5	+2.5	+7.0
Compound sentences and sentence parts	13	66.0	67.5	70.1	71.8	74.4	+1.5	+2.6	+1.7	+2.6	+8.4
Complex sentences	14	68.9	70.2	72.8	74.5	77.2	+1.3	+2.6	+1.7	+2.7	+8.3
Conjunctions	10	84.3	83.8	83.5	84.4	84.8	-0.5	-0.3	+0.9	+0.4	+0.5
Sentence recognition	**40**	**75.2**	**75.5**	**75.9**	**76.9**	**77.9**	**+0.4**	**+0.3**	**+1.0**	**+1.0**	**+2.7**
Supplying subjects	13	90.5	90.5	90.7	91.2	91.6	-0-	+0.2	+0.5	+0.4	+1.1
Supplying verbs	13	84.7	84.8	84.8	85.8	86.7	+0.1	+0.0	+1.0	+0.9	+2.0
Forming complete sentences	14	52.1	53.3	53.9	55.4	57.0	+1.2	+0.6	+1.5	+1.6	+4.9
Language choices	**30**	**75.0**	**74.7**	**74.3**	**75.0**	**76.4**	**-0.3**	**-0.4**	**+0.7**	**+1.4**	**+1.4**
Sensory words	10	75.8	75.9	75.3	76.0	76.6	+0.1	-0.6	+0.7	+0.6	+0.8
Specific words and sentences	10	67.1	67.0	66.9	67.4	69.8	-0.1	-0.1	+0.5	+2.4	+2.7
Achieving tone through word choices	10	82.0	81.3	80.7	81.4	82.7	-0.7	-0.6	+0.7	+1.3	+0.7
SUPPORTING SKILLS	**160**	**74.1**	**74.5**	**74.6**	**75.4**	**76.2**	**+0.4**	**+0.1**	**+0.8**	**+0.8**	**+2.1**
Standard usage	**50**	**78.2**	**78.3**	**78.1**	**78.6**	**79.5**	**+0.1**	**-0.2**	**+0.5**	**+0.9**	**+1.3**
Irregular verbs	10	77.5	77.7	78.0	78.7	79.0	+0.2	+0.3	+0.7	+0.3	+1.5
Pronouns	10	66.7	67.7	67.7	68.9	70.1	+1.0	-0-	+1.2	+1.2	+3.4
Subject-verb agreement	10	72.4	72.2	72.1	72.9	73.8	-0.2	-0.1	+0.8	+0.9	+1.4
Noun determiners	10	91.2	90.8	90.3	90.4	90.9	-0.4	-0.5	+0.1	+0.5	-0.3
Double negatives	10	83.0	82.8	82.4	82.2	83.9	-0.2	-0.4	-0.2	+1.7	+0.9
Word forms	**32**	**74.6**	**74.9**	**75.3**	**76.2**	**76.7**	**+0.3**	**+0.4**	**+0.9**	**+0.5**	**+2.1**
Suffixes	10	79.6	79.4	79.8	80.4	80.8	-0.2	+0.4	+0.6	+0.4	+1.2
Irregular noun plurals	10	71.3	71.5	71.6	72.1	72.6	+0.2	+0.1	+0.5	+0.5	+1.3
Contractions	12	73.2	74.0	74.7	76.1	76.9	+0.8	+0.7	+1.4	+0.8	+3.7
Spelling	**50**	**71.2**	**71.7**	**71.7**	**72.5**	**73.2**	**+0.5**	**-0-**	**+0.8**	**+0.7**	**+2.0**
Predictable words	15	73.2	74.0	74.4	74.9	75.9	+0.8	+0.4	+0.5	+1.0	+2.7
Words with suffixes	15	64.4	64.8	64.5	65.5	65.8	+0.4	-0.3	+1.0	+0.3	+1.4
Demons	10	76.8	77.1	76.6	77.8	78.5	+0.3	-0.5	+1.2	+0.7	+1.7
Homophones	10	72.9	73.2	73.6	74.4	75.3	+0.3	+0.4	+0.8	+0.9	+2.4
Capitalization and punctuation	**28**	**71.5**	**72.3**	**72.9**	**73.8**	**75.0**	**+0.8**	**+0.6**	**+0.9**	**+1.2**	**+3.5**
Capitalization	14	70.6	71.1	71.4	72.2	73.4	+0.5	+0.3	+0.8	+1.2	+2.8
Punctuation	14	72.4	73.6	74.5	75.4	76.8	+1.2	+0.9	+0.9	+1.4	+4.4

Written Expression Scores of California Eighth Grade Students on the *Survey of Academic Skills: Grade 8*, 1983-84 Through 1985-86

Skill area	Number of questions	Average percent correct score			Change in score		Total change
		83-84	84-85	85-86	83-84 to 84-85	84-85 to 85-86	83-84 to 85-86
WRITTEN EXPRESSION, TOTAL	**396**	**61.3**	**60.4**	**60.8**	**-0.9**	**+0.4**	**-0.5**
Writing Process Skills	**242**	**58.5**	**57.8**	**58.3**	**-0.7**	**+0.5**	**-0.2**
Prewriting organization	16	65.9	64.8	65.8	-1.1	+1.0	-0.1
Selecting titles	16	72.8	70.3	70.6	-2.5	+0.3	-2.2
Critical judgments	37	56.4	55.2	55.8	-1.2	+0.6	-0.6
Judging students' writing	16	53.0	52.3	53.3	-0.7	+1.0	+0.3
Critical thinking	21	59.1	57.5	57.8	-1.6	+0.3	-1.3
Overall organization	44	53.0	51.7	52.0	-1.3	+0.3	-1.0
Analyzing	13	56.8	55.0	56.0	-1.8	+1.0	-0.8
Improving overall organization	17	52.4	51.1	51.1	-1.3	-0-	-1.3
Using transitional elements	14	50.3	49.5	49.4	-0.8	-0.1	-0.9
Paragraphs	31	57.5	55.8	56.1	-1.7	+0.3	-1.4
Analyzing structure	16	56.0	54.9	55.3	-1.1	+0.4	-0.7
Improving paragraphs	15	59.1	56.8	56.9	-2.3	+0.1	-2.2
Sentence manipulation	32	61.7	59.4	60.2	-2.3	+0.8	-1.5
Combining sentences	15	63.4	61.1	61.9	-2.3	+0.8	-1.5
Using effective and economic sentences	17	—	57.9	58.7	—	+0.8	—
Sentence recognition	30	47.6	55.2	55.5	—	+0.3	+7.9
Run-ons and fragments	15	46.0	53.6	53.7	—	+0.1	+7.7
Recognizing complete sentences	15	—	56.7	57.2	—	+0.5	—
Language choices	36	64.0	61.8	62.0	-2.2	+0.2	-2.0
Specificity/sensory/tone	16	59.7	57.4	57.0	-2.3	-0.4	-2.7
Precise word choices	20	67.5	65.4	66.1	-2.1	+0.7	-1.4
Supporting Skills	**154**	**64.7**	**64.4**	**64.8**	**-0.3**	**+0.4**	**+0.1**
Standard English usage	31	65.4	64.3	64.7	-1.1	+0.4	-0.7
Verbs	15	65.2	63.4	64.0	-1.8	+0.6	-1.2
Pronouns and modifiers	16	66.4	65.1	65.4	-1.3	+0.3	-1.0
Capitalization and punctuation	31	61.7	60.4	61.2	-1.3	+0.8	-0.5
Capitalization	16	61.0	60.0	61.0	-1.0	+1.0	-0-
Punctuation	15	62.6	60.9	61.4	-1.7	+0.5	-1.2
Spelling	92	65.2	65.8	66.1	+0.6	+0.3	+0.9
Predictables	28	69.6	69.1	69.5	-0.5	+0.4	-0.1
Suffixes	19	64.2	64.9	64.8	+0.7	-0.1	+0.6
Demons	30	63.9	64.9	65.6	+1.0	+0.7	+1.7
Homophones	15	62.3	62.3	62.3	-0-	-0-	-0-
Written Expression in the Content Areas		**59.8**	**59.2**	**59.6**	**-0.6**	**+0.4**	**-0.2**
Spelling	92	65.2	65.8	66.1	+0.6	+0.3	+0.9
In reading and literature (general)	49	60.4	60.9	61.0	+0.5	+0.1	+0.6
In science	19	70.4	70.9	71.8	+0.5	+0.9	+1.4
In social studies	24	70.7	71.7	72.0	1.0	+0.3	+1.3
Language choices	36	64.0	61.8	62.0	-2.2	+0.2	-2.0
In response to literature	12	62.7	60.6	61.0	-2.1	+0.4	-1.7
In science	12	70.0	67.7	67.8	-2.3	+0.1	-2.2
In social studies	12	59.4	57.3	57.3	-2.1	-0-	-2.1
Sentence recognition and manipulation	62	54.8	57.4	57.9	+2.6	+0.5	+3.1
In response to literature	22	60.8	58.5	58.7	-2.3	+0.2	-2.1
In science	21	51.0	56.6	57.4	+5.6	+0.8	+6.4
In social studies	19	—	57.0	57.5	—	+0.5	—
Paragraphs and overall organization	75	54.8	53.4	53.7	-1.4	+0.3	-1.1
In response to literature	25	56.8	55.6	55.9	-1.2	+0.3	-0.9
In science	25	53.7	52.2	52.6	-1.5	+0.4	-1.1
In social studies	25	54.1	52.5	52.5	-1.6	-0-	-1.6
Critical judgments	37	56.4	55.2	55.8	-1.2	+0.6	-0.6
In response to literature	12	53.2	52.4	53.4	-0.8	+1.0	+0.2
In science	11	54.8	53.0	53.2	-1.8	+0.2	-1.6
In social studies	14	60.6	59.5	59.9	-1.1	+0.4	-0.7

Written Expression Scores of California Twelfth Grade Students on the *Survey of Basic Skills: Grade 12*, 1975-76 Thorugh 1985-86

Skill area	Number of questions	Average percent correct score											Change in average percent correct score										Total change, 75-76 to 85-86
		75-76	76-77	77-78	78-79	79-80	80-81	81-82	82-83	83-84	84-85	85-86	75-76 to 76-77	76-77 to 77-78	77-78 to 78-79	78-79 to 79-80	79-80 to 80-81	80-81 to 81-82	81-82 to 82-83	82-83 to 83-84	83-84 to 84-85	84-85 to 85-86	
TOTAL WRITTEN EXPRESSION	**142**	**62.3**	**61.9**	**62.1**	**62.4**	**62.4**	**63.1**	**63.2**	**63.0**	**62.6**	**63.2**	**63.4**	**-0.4**	**+0.2**	**+0.3**	**-0-**	**+0.7**	**+0.1**	**-0.2**	**-0.4**	**+0.6**	**+0.2**	**1.1**
Writing process skills																							
Paragraphs	26	59.9	59.1	59.3	59.7	59.7	60.2	60.5	60.3	59.8	60.7	60.6	-0.8	+0.2	+0.4	-0-	+0.5	+0.3	-0.2	-0.5	+0.9	-0.1	0.7
Sentence manipulation	12	42.9	42.9	43.4	43.7	43.7	44.3	44.6	44.6	44.4	45.1	45.3	-0-	+0.5	+0.3	-0-	+0.6	+0.3	-0-	-0.2	+0.7	+0.2	2.4
Sentence recognition	20	67.3	67.7	68.4	68.8	69.0	70.1	70.1	70.1	69.7	70.6	70.3	+0.4	+0.7	+0.4	+0.2	+1.1	-0-	-0-	-0.4	+0.9	-0.3	3
Language choices	32	66.9	66.7	66.6	66.6	66.3	66.7	66.9	66.3	65.4	65.6	66.0	-0.2	-0.1	-0-	-0.3	+0.4	+0.2	-0.6	-0.9	+0.2	+0.4	-0.9
Supporting skills																							
Word forms	24	72.6	72.1	72.1	71.9	72.2	72.5	72.1	71.5	70.9	71.5	72.1	-0.5	-0-	-0.2	+0.3	+0.3	-0.4	-0.6	-0.6	+0.6	+0.6	-0.5
Capitalization/punctuation	28	54.6	54.3	54.7	55.4	55.4	56.6	56.8	57.2	57.2	58.0	58.5	-0.3	+0.4	+0.7	-0-	+1.2	+0.2	+0.4	-0-	+0.8	+0.5	3.9
Spelling	72	68.0	67.9	68.4	68.4	68.8	69.0	69.5	69.5	69.4	69.7	70.1	-0.1	+0.5	-0-	+0.4	+0.2	+0.5	-0-	-0.1	+0.3	+0.4	2.1

APPENDIX D

Mathematics Assessment Advisory Committee

Janet Abbott, Chula Vista City School District
Joan Akers, Office of the San Diego County Superintendent of Schools
James Caballero, University of California, Los Angeles
Joe Cooney, Office of the San Mateo County Superintendent of Schools
Clyde Corcoran, Whittier Union High School District (Chair)
Richard Dean, California Institute of Technology
Sister Rose Eleanor Ehret, Holy Names College
Joan Gell, Palos Verdes High School, Palos Verdes Peninsula Unified School District
Ruth Hadley, Mathematics Consultant, Santa Maria
Bob Hamada, Los Angeles Unified School District
Roberta Koss, Redwood High School, Tamalpais Union High School District
Thomas Lester, San Juan Unified School District
Gail Lowe, Acacia Elementary School, Conejo Valley Unified School District
Sandra Marshall, San Diego State University
Vance Mills, San Diego Unified School District
Susan Ostergard, University of California, Davis
Henry Palmer, Office of the Los Angeles County Superintendent of Schools
Annie Podesto, Stockton Unified School District
Gail Robinette, Fresno Unified School District
Ed Silver, San Diego State University
Tony Spears, Office of the Fresno County Superintendent of Schools
Jean Stenmark, EQUALS, University of California, Berkeley
Harold Taylor, Hillsdale High School, San Mateo Union High School District
Shirley Trembley, Bakersfield College
Lee Webb, California State College, Bakersfield
Les Winters, Los Angeles Board of Education
Dorothy Wood, Redwood High School, Tamalpais Union High School District

Tej Pandey, State Department of Education Cosnultant to the Committee

Mathematics Scores of California Third Grade Students on the *Survey of Basic Skills: Grade 3*, 1979-80 Through 1985-86

Skill area	No. of questions	Mean score							Change in score						Total change, 79-80 to 85-86
		79-80	80-81	81-82	82-83	83-84	84-85	85-86	79-80 to 80-81	80-81 to 81-82	81-82 to 82-83	82-83 to 83-84	83-84 to 84-85	84-85 to 85-86	
MATHEMATICS, TOTAL	360	74.1	74.7	76.0	77.1	78.3	79.1	79.9	+0.6	+1.3	+1.1	+1.2	+0.8	+0.8	+5.8
Arithmetic	245	74.5	75.1	76.4	77.7	78.9	79.7	80.3	+0.6	+1.3	+1.3	+1.2	+0.8	+0.6	+5.8
Count and place value	45	79.3	79.9	81.3	82.3	83.1	84.1	84.9	+0.6	+1.4	+1.0	+0.8	+1.0	+0.8	+5.6
Skills	30	79.7	80.3	81.9	82.7	83.5	84.4	85.1	+0.6	+1.6	+0.8	+0.8	+0.9	+0.7	+5.4
Applications	15	78.5	79.1	80.3	81.5	82.4	83.4	84.4	+0.6	+1.2	+1.2	+0.9	+1.0	+1.0	+5.9
Operations	155	72.7	73.3	74.8	76.3	77.7	78.3	78.8	+0.6	+1.5	+1.5	+1.4	+0.6	+0.5	+6.1
Basic facts	25	85.9	86.3	87.5	88.4	89.6	89.9	90.3	+0.4	+1.2	+0.9	+1.2	+0.3	+0.4	+4.4
Addition	30	82.6	83.4	84.7	86.0	87.0	87.5	87.9	+0.8	+1.3	+1.3	+1.0	+0.5	+0.4	+5.3
Subtraction	30	69.9	71.0	73.1	75.3	76.4	76.9	77.7	+1.1	+2.1	+2.2	+1.1	+0.5	+0.8	+7.8
Multiplication	30	63.7	64.5	66.7	68.6	71.0	72.0	72.5	+0.8	+2.2	+1.9	+2.4	+1.0	+0.5	+8.8
Application	40	65.7	65.9	66.7	67.9	69.2	69.8	70.5	+0.2	+0.8	+1.2	+1.3	+0.6	+0.7	+4.8
Basic facts	13	68.0	67.9	68.6	69.8	71.0	71.7	72.2	-0.1	+0.7	+1.2	+1.2	+0.7	+0.5	+4.2
Addition/subtraction	15	75.0	76.0	77.4	79.0	80.0	81.0	81.9	+1.0	+1.4	+1.6	+1.0	+1.0	+0.9	+6.9
Multiplication	12	51.4	51.2	51.2	52.1	53.4	53.7	54.6	-0.2	-0-	+0.9	+1.3	+0.3	+0.9	+3.2
Nature of numbers and properties	45	75.8	76.3	77.4	77.9	79.0	80.1	81.0	+0.5	+1.1	+0.5	+1.1	+1.1	+0.9	+5.2
Properties and relationships	15	76.0	76.4	77.5	77.1	77.6	78.7	79.7	+0.4	+1.1	-0.4	+0.5	+1.1	+1.0	+3.7
Money and fractions	15	80.2	81.1	82.4	83.4	85.4	86.5	87.1	+0.9	+1.3	+1.0	+2.0	+1.1	+0.6	+6.9
Applications	15	71.1	71.5	72.2	73.2	74.1	75.2	76.1	+0.4	+0.7	+1.0	+0.9	+1.1	+0.9	+5.0
Geometry	30	74.9	75.1	76.6	77.1	78.4	79.5	80.6	+0.2	+1.5	+0.5	+1.3	+1.1	+1.1	+5.7
Skills	20	76.3	76.3	77.7	78.3	79.5	80.5	81.7	-0-	+1.4	+0.6	+1.2	+1.0	+1.2	+5.4
Applications	10	72.0	72.8	74.3	74.8	76.2	77.3	78.5	+0.8	+1.5	+0.5	+1.4	+1.1	+1.2	+6.5
Measurement	40	73.4	74.0	74.6	75.3	76.4	77.4	78.1	+0.6	+0.6	+0.7	+1.1	+1.0	+0.7	+4.7
Linear measures	15	69.7	70.6	72.0	72.3	73.5	74.6	75.4	+0.9	+1.4	+0.3	+1.2	+1.1	+0.8	+5.7
Other measures	15	78.4	78.6	78.3	79.1	79.9	80.8	81.4	+0.2	-0.3	+0.8	+0.8	+0.9	+0.6	+3.0
Applications	10	71.4	72.2	72.8	74.2	75.6	76.4	77.1	+0.8	+0.6	+1.4	+1.4	+0.8	+0.7	+5.7
Patterns and graphs	30	73.6	74.6	75.9	76.6	78.0	78.9	80.0	+0.6	+1.3	+0.9	+1.2	+0.9	+1.1	+6.2
Skills	15	63.5	64.1	65.7	66.2	67.5	68.8	70.2	+0.6	+1.6	+0.5	+1.3	+1.3	+1.4	+6.7
Applications	15	84.1	85.0	86.2	87.4	88.4	88.9	89.9	+0.9	+1.2	+1.2	+1.0	+0.5	+1.0	+5.8
Problem analysis and models	15	70.1	70.5	71.2	72.5	73.7	74.5	75.9	+0.4	+0.7	+1.3	+1.2	+0.8	+1.4	+5.8
Problem solving/applications*	120	71.5	72.3	73.2	74.4	75.6	76.3	77.3	+0.8	+0.9	+1.2	+1.2	+0.7	+1.0	+5.8

Mathematics Scores of California Sixth Grade Students on the *Survey of Basic Skills: Grade 6*, 1981-82 Through 1985-86

Skill area	No. of questions	Average percent correct					Change				Total change,
		81-82	82-83	83-84	84-85	85-86	81-82 to 82-83	82-83 to 83-84	83-84 to 84-85	84-85 to 85-86	81-82 to 85-86
MATHEMATICS, TOTAL	480	62.7	63.2	63.3	64.1	65.2	+0.5	+0.1	+0.8	+1.1	+2.5
Counting, numeration, and place value	40	64.7	66.6	67.1	67.9	69.0	+1.9	+0.5	+0.8	+1.1	+4.3
Skills	25	66.2	68.2	68.9	69.7	70.7	+2.0	+0.7	+0.8	+1.0	+4.5
Count and numeration	15	67.4	68.6	68.9	69.8	70.8	+1.2	+0.3	+0.9	+1.0	+3.4
Place value	10	64.5	67.6	68.9	69.6	70.6	+3.1	+1.3	+0.7	+1.0	+6.1
Applications	15	62.1	64.0	64.1	64.8	66.0	+1.9	+0.1	+0.7	+1.2	+3.9
Nature of numbers and properties	50	61.6	61.5	61.3	62.2	62.7	-0.1	-0.2	+0.9	+0.5	+1.1
Skills	35	61.4	61.3	61.3	62.1	62.7	-0.1	-0-	+0.8	+0.6	+1.3
Ordering and properties	15	67.1	67.0	66.6	67.2	67.2	-0.1	-0.4	+0.6	+0.0	+0.1
Classification of numbers	20	57.1	57.0	57.3	58.3	59.2	-0.1	+0.3	+1.0	+0.9	+2.1
Applications	15	62.1	62.0	61.5	62.4	62.8	-0.1	-0.5	+0.9	+0.4	+0.7
Operations	145	62.3	63.1	63.4	64.1	64.8	+0.8	+0.3	+0.7	+0.7	+2.5
Skills	98	65.6	66.6	67.0	67.7	68.3	+1.0	+0.4	+0.7	+0.6	+2.7
Addition/subtraction of whole numbers	15	79.2	79.4	78.9	79.3	79.7	+0.2	-0.5	+0.4	+0.4	+0.5
Multiplication of whole numbers	14	78.9	79.9	79.7	80.0	80.5	+1.0	-0.2	+0.3	+0.5	+1.6
Division of whole numbers	15	72.1	73.6	74.1	74.3	75.0	+1.5	+0.5	+0.2	+0.7	+2.9
Addition/subtraction of decimals	14	56.3	56.9	57.5	58.9	60.3	+0.6	+0.6	+1.4	+1.4	+4.0
Multiplication/division of decimals	12	54.0	57.5	59.0	59.5	59.9	+3.5	+1.5	+0.5	+0.4	+5.9
Operations on fractions	16	53.6	53.4	54.0	54.9	55.7	-0.2	+0.6	+0.9	+0.8	+2.1
Percents and equivalent fractions/decimals	12	63.6	63.9	64.8	65.9	66.0	+0.3	+0.9	+1.1	+0.1	+2.4
Applications	47	55.4	55.8	56.0	56.6	57.4	+0.4	+0.2	+0.6	+0.8	+2.0
One-step problems involving whole numbers	12	68.5	68.9	69.0	69.4	70.4	+0.4	+0.1	+0.4	+1.0	+1.9
One-step problems involving rational numbers	20	52.9	53.3	53.3	53.8	54.4	+0.4	+0.0	+0.5	+0.6	+1.5
Two (or more) step problems	15	48.4	48.8	49.3	50.1	51.1	+0.4	+0.5	+0.8	+1.0	+2.7
Expressions, equations, and coordinate graphs	42	63.1	63.9	63.6	64.7	65.5	+0.8	-0.3	+1.1	+0.8	+2.4
Skills	27	62.5	63.4	63.0	63.9	64.8	+0.9	-0.4	+0.9	+0.9	+2.3
Expressions and equations	15	66.3	66.1	65.4	66.0	66.8	-0.2	-0.7	+0.6	+0.8	+0.5
Graphs and function tables	12	57.8	59.9	59.9	61.3	62.2	+2.1	-0-	+1.4	+0.9	+4.4
Applications	15	64.0	64.9	64.8	66.0	66.9	+0.9	-0.1	+1.2	+0.9	+2.9
Geometry	40	62.8	63.5	64.2	65.0	66.2	+0.7	+0.7	+0.8	+1.2	+3.4
Skills	24	63.0	64.1	64.8	65.5	67.0	+1.1	+0.7	+0.7	+1.5	+4.0
Shapes and terminology	12	64.9	65.4	65.5	66.0	67.9	+0.5	+0.1	+0.5	+1.9	+3.0
Relationships	12	61.1	62.7	64.1	65.0	66.0	+1.6	+1.4	+0.9	+1.0	+4.9
Applications	16	62.4	62.6	63.3	64.2	65.0	+0.2	+0.7	+0.9	+0.8	+2.6
Measurement	58	60.8	61.0	60.9	61.7	62.4	+0.2	-0.1	+0.8	+0.7	+1.6
Skills	42	62.1	62.4	62.1	62.8	63.5	+0.3	-0.3	+0.8	+0.6	+1.4
Metric units	20	59.2	60.0	60.0	60.5	61.3	+0.8	-0-	+0.5	+0.8	+2.1
U.S. Customary units	10	74.7	74.5	74.0	74.7	75.0	-0.2	-0.5	+0.7	+0.3	+0.3
Length, area, and volume	12	56.4	56.2	55.9	57.2	57.9	-0.2	-0.3	+1.3	+0.7	+1.5
Applications	16	57.6	57.3	57.6	58.3	59.3	-0.3	0.3	+0.7	+1.0	+1.7
Probability and statistics	23	60.1	59.8	59.5	60.5	61.2	-0.3	-0.3	+1.0	+0.7	+1.1
Probability	12	53.5	52.3	52.0	53.1	54.1	-1.2	-0.3	+1.1	+1.0	+0.6
Statistics	11	67.2	68.0	67.6	68.5	69.3	+0.8	-0.4	+0.9	+0.8	+2.1
Tables, graphs, and integrated applications	30	67.1	67.5	67.1	68.0	70.4	+0.4	-0.4	+0.9	+2.4	+3.3
Tables and graphs	15	68.3	69.0	69.0	70.1	72.2	+0.7	-0-	+1.1	+2.1	+3.9
Integrated applications	15	65.8	65.9	65.6	65.9	67.1	+0.1	-0.3	+0.3	+1.2	+1.3
Problem solving	52	63.3	63.5	63.3	64.2	62.9	+0.2	-0.2	+0.9	-1.3	-0.4
Formulation	15	70.1	70.1	69.4	70.5	71.9	-0-	-0.7	+1.1	+1.4	+1.8
Analysis and strategy	25	65.7	66.0	66.0	66.7	67.8	+0.3	-0-	+0.7	+1.1	+2.1
Interpretation	12	49.9	50.0	49.9	51.0	51.4	+0.1	-0.1	+1.1	+0.4	+1.5
Total, applications problems	154	60.7	61.2	61.3	62.1	62.1	+0.5	+0.1	+0.8	-0-	+1.4

Mathematics Scores of California Eighth Grade Students on the *Survey of Academic Skills: Grade 8*, 1983-84 Through 1985-86

Skill area	No. of questions	Average percent correct score			Change in score		Total change,
		83-84	84-85	85-86	83-84 to 84-85	84-85 to 85-86	83-84 to 85-86
MATHEMATICS, TOTAL	468	54.8	54.8	55.4	-0-	+0.6	+0.6
Numbers	72	58.6	58.5	59.5	-0.1	+1.0	+0.9
Skills and concepts	50	58.8	58.9	59.2	+0.1	+0.3	+0.4
Order relations and classification	15	65.6	65.7	66.0	+0.1	+0.3	+0.4
Number theory	20	55.8	56.1	56.6	+0.3	+0.5	+0.8
Properties	15	56.0	55.7	55.9	-0.3	+0.2	-0.1
Applications	22	58.0	57.7	60.3	-0.3	+2.6	+2.3
Operations	72	57.4	57.3	57.4	-0.1	+0.1	-0-
Skills/concepts	36	60.4	60.2	60.3	-0.2	+0.1	-0.1
Whole and rational numbers	22	61.3	61.2	61.1	-0.1	-0.1	-0.2
Percents	14	58.9	58.8	59.1	+0.1	+0.3	+0.2
Applications	36	54.6	54.7	54.4	+0.1	-0.3	-0.2
One-step	20	57.5	57.7	57.2	-0.7	-+0.5	-0.3
Two or more steps	16	49.3	51.0	50.9	+1.7	-0.1	1.6
Algebra	72	51.8	52.0	52.7	+0.2	+0.7	+0.9
Skills and concepts	50	50.9	51.4	52.1	+0.5	+0.7	+1.2
Expressions, equations, and inequalities	30	53.2	53.4	54.1	+0.2	+0.7	+0.9
Graphs and functions	20	47.6	48.2	49.1	+0.6	+0.9	+1.5
Applications	22	53.7	53.5	54.0	-0.2	+0.5	+0.3
Geometry	72	50.7	51.0	51.1	+0.3	+0.1	+0.4
Skills and concepts	47	49.3	49.7	50.6	+0.4	+0.9	+1.3
Geometric terms and figures	20	50.5	51.2	52.1	+0.7	+0.9	+1.6
Relationships	27	48.2	48.4	49.4	+0.2	+1.0	+1.2
Applications	25	51.1	51.0	52.0	-0.1	+1.0	+0.9
Measurement	42	48.3	48.5	49.2	+0.2	+0.7	+0.9
Skills and concepts	24	50.3	50.2	51.8	-0.1	+1.6	+1.5
Units and estimation	12	52.5	52.2	54.4	-0.3	+2.2	+1.9
Perimeter, area, volume	12	48.1	48.2	49.2	+0.1	+1.0	+1.1
Applications	18	45.8	46.3	45.8	+0.5	-0.5	-0-
Probability and statistics	36	45.1	45.8	45.8	+0.7	-0-	+0.7
Probability	18	47.2	46.8	46.9	-0.4	+0.1	-0.3
Statistics	18	43.0	44.8	44.7	+1.8	-0.1	+1.7
Tables, graphs, and integrated applications	30	60.2	60.[illegible]	60.8	+0.2	+0.4	+0.6
Tables and graphs	15	61.5	62.[illegible]	62.7	+0.6	+0.6	+1.2
Integrated applications	15	59.0	58.7	58.9	-0.3	+0.2	-0.1
Problem solving	72	62.2	61.5	62.2	-0.7	+0.7	-0-
Formulation of a problem	14	67.1	66.5	67.4	-0.6	+0.9	+0.3
Analysis of a problem	20	63.4	62.4	63.1	-1.0	+0.7	-0.3
Applying strategies	24	62.1	61.4	62.0	-0.7	+0.6	-0.1
Reasoning and interpretation	14	56.1	55.3	56.1	-0.8	+0.8	-0-
Problem Solving/Applications	261	55.5	55.3	55.8	-0.1	+0.5	+0.3

Mathematics Scores of California Twelfth Grade Students on the Survey of Basic Skills: Grade 12, 1975-76 Through 1985-86

Skill area	Number of questions	Average percent correct score											Change in average percent correct score									Total change
		75-76	76-77	77-78	78-79	79-80	80-81	81-82	82-83	83-84	84-85	85-86	75-76 to 76-77	76-77 to 77-78	77-78 to 78-79	78-79 to 79-80	79-80 to 80-81	80-81 to 81-82	81-82 to 82-83	82-83 to 83-84	83-84 to 84-85	84-85 to 85-86	75-76 to 84-85
MATHEMATICS, TOTAL	198	67.0	66.3	66.3	66.5	66.8	68.0	67.7	67.7	67.4	68.3	68.7	-0.7	-0-	+0.2	+0.3	+1.2	-0.3	-0-	-0.3	+0.9	+0.4	+1.7
Arithmetic	98	72.9	72.1	72.2	72.7	73.1	74.5	74.3	74.4	74.2	75.2	75.7	-0.8	+0.1	+0.5	+0.4	+1.4	-0.2	+0.1	-0.2	+1.0	+0.5	+2.8
Number concepts	28	74.3	73.5	73.6	73.9	74.1	75.4	75.0	75.2	75.1	76.0	77.0	-0.8	+0.1	+0.3	+0.2	+1.3	-0.4	+0.2	-0.1	+0.9	+1.0	+2.7
Number and numeration	14	71.0	70.1	69.9	70.1	70.6	72.1	72.1	72.6	72.9	73.8	74.7	-0.9	-0.2	+0.2	+0.5	+1.5	-0-	+0.5	+0.3	+0.9	+0.9	+3.7
Number theory	8	76.2	75.9	76.4	76.9	76.7	77.7	76.9	76.7	76.0	77.4	78.3	-0.3	+0.5	+0.5	-0.2	+1.0	-0.8	-0.2	-0.7	+1.4	+0.9	+2.1
Number properties	6	79.6	78.5	78.6	78.8	78.7	79.8	79.1	79.3	78.9	79.3	80.6	-1.1	+0.1	+0.2	-0.1	+1.1	-0.7	+0.2	-0.4	+0.4	+1.3	+1.0
Whole numbers	22	80.1	80.1	80.1	80.6	81.0	81.7	81.6	81.6	81.0	81.8	81.7	-0-	-0-	+0.5	+0.4	+0.7	-0.1	-0-	-0.6	+0.8	-0.1	+1.6
Computation	14	80.9	81.0	81.2	81.9	82.4	83.5	83.6	83.8	83.5	84.5	84.4	+0.1	+0.2	+0.7	+0.5	+1.1	+0.1	+0.2	-0.3	+1.0	-0.1	+3.5
Application	8	78.7	78.5	78.2	78.3	78.4	78.6	78.0	77.7	76.6	77.1	76.9	-0.2	-0.3	+0.1	+0.1	+0.2	-0.6	-0.3	-1.1	+0.5	-0.2	-1.8
Fractions	26	66.0	64.5	64.3	64.7	65.0	66.3	66.1	65.9	65.8	67.1	67.8	-1.5	-0.2	+0.4	+0.3	+1.3	-0.2	-0.2	-0.1	+1.3	+0.7	+1.8
Computation	14	70.4	68.3	68.4	69.0	69.6	71.5	71.5	71.2	71.6	73.3	74.2	-2.1	+0.1	+0.6	+0.6	+1.9	-0-	-0.3	+0.4	+1.7	+0.9	+3.8
Application	12	60.9	60.0	59.5	59.6	59.7	60.2	59.9	59.7	59.0	58.8	63.0	-0.9	-0.5	+0.1	+0.1	+0.5	-0.3	-0.2	-0.7	-0.2	+4.2	+2.1
Decimals	22	71.8	71.2	72.0	72.9	73.7	75.8	75.8	76.3	76.2	77.0	77.6	-0.6	+0.8	+0.9	+0.8	+2.1	-0-	+0.5	-0.1	+0.8	+0.6	+5.8
Computation	14	74.1	73.8	74.8	75.8	76.7	79.1	79.2	80.0	80.1	81.0	81.6	-0.3	+1.0	+1.0	+0.9	+2.4	+0.1	+0.8	+0.1	+0.9	+0.6	+7.5
Application	8	67.8	66.6	67.2	67.7	68.3	70.1	69.9	69.8	69.2	70.0	74.0	-1.2	+0.6	+0.5	+0.6	+1.8	-0.2	-0.1	-0.6	+0.8	+4.0	+6.2
Algebra	32	62.9	62.1	61.8	62.1	62.3	63.5	63.2	63.3	63.0	64.2	64.5	-0.8	-0.3	+0.3	+0.2	+1.2	-0.3	+0.1	-0.3	+1.2	+0.3	+1.6
Computation	14	66.4	65.9	65.5	66.0	66.4	67.6	67.5	67.7	67.8	68.9	69.6	-0.5	-0.4	+0.5	+0.4	+1.2	-0.1	+0.2	+0.1	+1.1	+0.7	+3.2
Application	18	60.1	59.2	58.8	59.1	59.1	60.2	59.9	60.0	59.2	60.6	60.5	-0.9	-0.4	+0.3	-0-	+1.1	-0.3	+0.1	-0.8	+1.4	-0.1	+0.4
Geometry	24	62.7	62.1	61.8	61.8	62.0	62.4	62.4	62.1	62.1	62.8	63.0	-0.6	-0.3	-0-	+0.2	+0.4	-0-	-0.3	-0-	+0.7	+0.2	+0.3
Knowledge of facts	12	75.2	75.5	75.5	75.4	75.5	76.0	76.0	75.6	75.6	76.0	76.0	+0.3	-0-	-0.1	+0.1	+0.5	-0-	-0.4	-0-	+0.4	+0.0	+0.8
Application	12	50.1	48.7	48.1	48.3	48.4	48.8	48.8	48.6	48.6	49.6	49.9	-1.4	-0.6	+0.2	+0.1	+0.4	-0-	-0.2	-0-	+1.0	+0.3	-0.2
Measurement	30	60.5	59.5	59.4	59.0	59.2	60.0	59.3	59.0	58.2	58.7	58.5	-1	-0.1	-0.4	+0.2	+0.8	-0.7	-0.3	-0.8	+0.5	-0.2	-2.0
Knowledge of facts	12	71.6	70.5	70.1	69.7	69.6	70.8	69.7	69.1	67.8	68.0	68.3	-1.1	-0.4	-0.4	-0.1	+1.2	-1.1	-0.6	-1.3	+0.2	+0.3	-3.3
Application	18	53.1	52.2	52.2	51.9	52.2	52.9	52.4	52.3	51.8	52.4	52.0	-0.9	-0-	-0.3	+0.3	+0.7	-0.5	-0.1	-0.5	+0.6	-0.4	-1.1
Probability and statistics	14	57.2	56.9	57.3	57.4	57.8	59.2	58.8	58.6	58.5	59.6	60.4	-0.3	+0.4	+0.1	+0.4	+1.4	-0.4	-0.2	-0.1	+1.1	+0.8	+3.2
Computation	6	57.9	57.6	58.3	59.0	59.6	61.3	61.3	60.8	61.3	62.8	64.5	-0.3	+0.7	+0.7	+0.6	+1.7	-0-	-0.5	+0.5	+1.5	+1.7	+6.6
Application	8	56.6	56.3	56.5	56.2	56.5	57.6	57.0	56.9	56.5	57.2	58.1	-0.3	+0.2	-0.3	+0.3	+1.1	-0.6	-0.1	-0.4	+0.7	+0.9	+1.5
All application problems	62	61.8	60.7	60.6	60.7	60.9	61.7	61.3	61.2	60.5	61.3	61.3	-1.1	-0.1	+0.1	+0.2	+0.8	-0.4	-0.1	-0.7	+0.8	-0-	-0.5
Arithmetic	28	68.5	67.2	67.1	67.2	67.5	68.3	67.9	67.7	67.0	67.7	67.9	-1.3	-0.1	+0.1	+0.3	+0.8	-0.4	-0.2	-0.7	+0.7	+0.2	-0.6
Graphs	34	56.2	55.4	55.2	55.3	55.4	56.2	55.7	55.7	55.1	56.0	55.8	-0.8	-0.2	+0.1	+0.1	+0.8	-0.5	-0-	-0.6	+0.9	-0.2	-0.4

APPENDIX E

History-Social Science Assessment Advisory Committees

Steering Committee

Todd Clark, Committee Chairperson; Education Director, Constitutional Rights Foundation
Marlowe Berg, Professor, Elementary Education, San Diego State University
Margaret Branson, Director of Curriculum Services, Office of the Kern County Superintendent of Schools
Diane Brooks, History-Social Science Unit, State Department of Education
Jean Claugus, Legislative Representative, California Council for the Social Studies
Roy Erickson, Program Specialist, Social Studies/Multicultural, San Juan Unified School District
Jack Hoar, Consultant, Social Studies, Long Beach Unified School District
Carol Marquis, 1984-85 President, California Council for the Social Studies; Teacher, Monte Vista High School, San Ramon Valley Unified School District
Jan Talbot, Social Studies Consultant, Sacramento

Critical Thinking Specialists

Bruce Choppin, UCLA (now deceased)
Arthur Costa, School of Education, California State University, Sacramento
Robert Ennis, Department of Education, University of Illinois
Edward Glaser, Human Interaction Institute, Los Angeles
Dana Kurfman, Supervisor, Social Studies, K—12, Prince George's County Public Schools, Maryland
Carol Labar, University of British Columbia
Jason Millman, Department of Education, Cornell University
Richard Paul, Professor, Sonoma State University, Rohnert Park, California
Edys Quellmalz, School of Education, Stanford University
Perry Weddle, Department of Philosophy, California State University, Sacramento

Statewide Advisory Committee

Marvin Awbrey, Fresno Unified School District, Education Center
Jim Beck, Social Studies Teacher, Yreka High School, Yreka Union High School District
Jim Fletcher, Social Studies Teacher, Roosevelt Junior High School, Modesto City School District
Patricia Geyer, Teacher, Hiram Johnson High School, West Campus, Sacramento City Unified School District
Jeanette Haseyama, Social Studies Teacher, Marcy Elementary, San Diego Unified School District
Ralph Inzunza, Teacher, Sweetwater Senior High, Sweetwater Union High School District

Marvin Locke, Assistant Superintendent, Office of the Tehama County Superintendent of Schools
Raul Martinez, Social Studies Teacher, Cecil Avenue Junior High, Delano Union Elementary School District
Al Rocca, Teacher, Sequoia Junior High, Redding Elementary School District
Jim Schnarr, Social Studies Teacher, Stephen M. White Junior High, Los Angeles Unified School District
Janie Taylor, Teacher/Advisor, Region E, Los Angeles Unified School District
Lee Thompson, Consultant, Social Studies, Office of the Los Angeles County Superintendent of Schools
Marielle Tsukamoto, Social Studies Teacher, Sylvia Cassell Elementary School, Alum Rock Union Elementary School District
Becca Wachtmann, Curriculum Coordinator, Lucia Mar Unified School District
JoDean Wara, History/Economics Teacher, Vacaville High School, Vacaville Unified School District
Bob Watanabe, Director, Curriculum/Instructional Services, Office of the Contra Costa County Superintendent of Schools
Patricia Willett, Department Chairperson, Social Studies, Dodson Junior High, Los Angeles Unified School District

Critical Thinking/Writing Subcommittee

Jan Talbot, Chairperson; Social Studies Consultant, Sacramento
Rita King, Social Studies Resource Teacher, Office of the San Diego County Superintendent of Schools
Eleanor Mathew, Program Consultant, San Francisco Unified School District
Marylou Meerson, Curriculum Coordinator, Cajon Valley Union Elementary School District
John Phillips, Social Studies Consultant, Sacramento
Edys Quellmalz, School of Education, Stanford University
Jim Scarpino, Chairman, Social Studies Department, Canejo Valley Unified School District

Critical Thinking/Implementation Models Subcommittee

Rita King, Chairperson; Office of the San Diego County Superintendent of Schools
Jim Bell, Office of the San Diego County Superintendent of Schools
Pat Krum, Santee School District
Doug Rider, Office of the San Diego County Superintendent of Schools
Jim Rogers, Office of the San Diego County Superintendent of Schools
Shirley Hardy, San Diego Unified School District
Allen Scholl, Los Angeles Unified School District
Jan Talbot, Social Studies Consultant, Sacramento
Diane Watanabe, Office of the Los Angeles County Superintendent of Schools

Geography Subcommittee

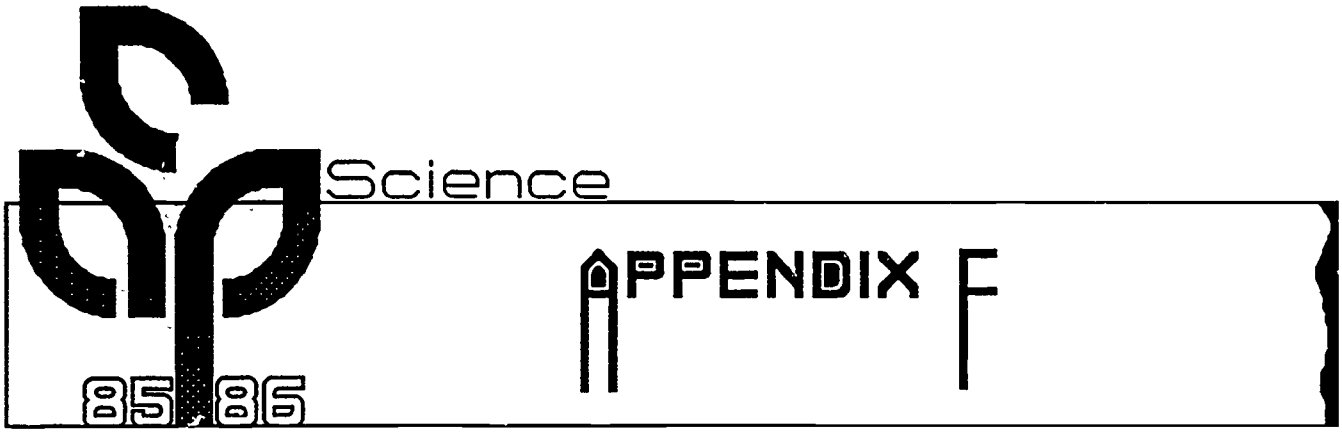
Philip Bacon, University of Houston
Emmet Hayes, Geographer, La Puente High School, Hacienda-La Puente Unified School District
Estelle Lit, California State University, Northridge
Robert Richardson, Professor, California State University, Sacramento
Lucile Robinson, Curriculum Administration, Ontario-Montclair School District
Kit Salter, University of California, Los Angeles

CAP Consultant to the Assessment Advisory Committees

Peter Kneedler

Results of the Grade Eight History-Social Science Test, 1984-85 Through 1985-86

Skill area	Statewide percent correct 84-85	Statewide percent correct 85-86	Change in score, 84-85 to 85-86
HISTORY-SOCIAL SCIENCE, TOTAL	**56.0**	**54.7**	-1.3
U.S. HISTORY	**57.1**	**55.8**	-1.3
Ideals, institutions, and values	56.5	56.2	-0.3
Influence of geography	51.8	51.6	-0.2
Issues, events, episodes	54.8	53.6	-1.2
Contributions of individuals and groups	64.9	61.9	-3.0
CITIZENSHIP/GOVERNMENT	**57.4**	**55.9**	-1.5
Shared and diverse heritage	56.7	54.2	-2.5
Basic documents	56.2	54.8	-1.4
Structures and processes	55.5	53.5	-2.0
Rights and responsibilities	60.1	59.3	-0.8
WORLD HISTORY/CULTURES	**52.8**	**51.4**	-1.4
Major epochs and turning points	51.2	50.3	-0.9
Contributions of individuals and groups	49.3	47.0	-2.3
Continuity, change, interdependence	58.5	56.8	-1.7
GEOGRAPHY/ECONOMICS	**54.9**	**53.4**	-1.5
Physical geography	52.1	50.6	-1.5
Human geography	59.5	58.4	-1.1
Geographic systems	45.2	45.2	-0-
Economic concepts	56.5	54.4	-2.1
BASIC SKILLS	**57.9**	**57.2**	-0.7
Maps, graphs, and political cartoons	60.0	59.1	-0.9
Locating and organizing information	54.4	54.0	-0.4
Vocabulary	55.4	54.9	-0.5
History-social science vocabulary	52.2	50.8	-1.4
Critical thinking vocabulary	59.6	60.5	+0.9
CRITICAL THINKING SKILLS	**60.4**	**58.9**	-1.5
Defining and Clarifying Problems	62.9	61.1	-1.8
Central issues	66.4	64.9	-1.5
Comparing similarities and differences	59.4	57.5	-1.9
Relevant information	61.0	58.9	-2.1
Formulating questions	67.0	65.0	-2.0
Judging Information Related to the Problem	57.9	56.7	-1.2
Fact, opinion	68.0	67.5	-0.5
Consistency	53.9	52.2	-1.7
Assumptions	59.0	57.5	-1.5
Stereotypes and cliches	50.3	50.0	-0.3
Bias, propaganda, slanting	52.4	51.1	-1.3
Value orientations and ideologies	65.7	64.1	-1.6
Solving Problems/Drawing Conclusions	60.3	59.0	-1.3
Adequacy of data	61.3	60.4	-0.9
Probable consequences and causality	59.5	57.9	-1.6



Science Assessment Advisory Committee

JoAnn Aiello, Laguna Salada Union Elementary School District
Joe Carter, Anaheim Union High School District
Dorothy Chang-Van Horn, Los Angeles Unified School District
Diane Conradson, San Jose State University
Robert Dean, Office of the San Diego County Superintendent of Schools
Phil Gay, San Diego City Unified School District
Dave Hammond, San Juan Unified School District
Zac Hanscom, III, San Diego State University
Lars Helgeson, Office of the San Diego County Superintendent of Schools
Vergil Hettick, Santa Ana Unified School District
Linda Huetinck, Glendora Unified School District
Ken Kitajima, San Jose Unified School District
Arie Korporaal, Office of the Los Angeles County Superintendent of Schools
Alden Loomis, Montebello Unified School District
Larry Lowery, University of California, Berkeley
Richard Merrill, Mt. Diablo Unified School District
Gary Nakagiri, San Francisco Unified School District
Francis Perkins, San Diego City Unified School District
Karen Reynolds, University of California, Berkeley
Ed Rodevich, Office of the Orange County Superintendent of Schools
John Shive, Fresno Unified School District
Joan Steinberg, San Francisco Unified School District
Gilbert Yee, Fremont Unified School District

Zack Taylor, State Department of Education Consultant to the Committee
Linda Zimmerer, State Department of Education Consultant to the Committee

Special Consultant to the Science Assessment Advisory Committee: Melanie Dean, Science Consultant, San Diego

Science Scores of California Eighth Grade Students on the *Survey of Academic Skills: Grade 8*, 1985-86

Areas assessed in science	Percent correct
Biological Science	**51.4**
Cells	53.0
Plants	46.6
Protists	42.5
Animals	53.6
Human beings	56.8
Ecosystems	53.3
Genetics	44.6
Evolution	56.5
Earth Science	**54.2**
Astronomy	59.4
Geology and natural resources	59.0
Meteorology	47.9
Oceanography	47.6
Physical Science	**57.7**
Matter--physical states and changes	65.6
Matter--chemical and nuclear reactions	56.5
Mechanics	57.2
Energy: Sources and transformations	55.4
Energy: Heat	54.0
Energy: Light	46.4
Energy: Electricity and magnetism	60.1
Energy: Sound	62.6
Science, Technology, Individuals, and Society	**62.4**
Science processes and products	63.3
Science-technology-society interrelationships	59.3
Science-related careers	66.9
Safety and Manipulative Skills	**70.1**
Laboratory safety	71.4
Manipulative laboratory skills	68.7
Science Processes	**63.4**
Observing	68.0
Comparing	65.2
Organizing	61.9
Relating	61.4
Identifying relationships	58.4
Recognizing hypotheses	60.7
Experimentation	64.7
Interpreting	64.0
Inferring	64.1
Overall	58.6
Boys	59.6
Girls	57.3

Results of Science Research Questions Included on the *Survey of Academic Skills: Grade 8*, 1985-86

SCIENCE RESEARCH QUESTIONS-PERSONAL	Very much	Some	Very little	Not at all	Generally like (1 + 2)	Generally dislike (3 + 4)
1. I like science.	20.3 %	44.5 %	17.2 %	8.4 %	64.8 %	25.6 %
2. I enjoy science when I can do experiments.	47.7 %	35.0 %	7.8 %	4.1 %	82.7 %	11.9 %
3. I like to read about science.	13.4 %	45.6 %	24.2 %	12.0 %	59.0 %	36.2 %
4. Science helps me think and solve problems.	25.0 %	53.8 %	13.6 %	4.0 %	78.8 %	17.6 %
5. I enjoy watching science programs on TV.	13.2 %	37.2 %	23.8 %	16.0 %	50.4 %	39.8 %
6. I like to do science activities outside of school time.	10.4 %	35.1 %	26.3 %	15.1 %	45.5 %	41.4 %
7. Science is important to my future career plans.	24.1 %	40.0 %	18.7 %	11.6 %	64.1 %	30.3 %
8. I tell my parents what we do in science class.	15.2 %	42.3 %	24.2 %	14.2 %	57.5 %	38.4 %
9. Science teaches me how to be healthy.	15.5 %	38.8 %	19.8 %	17.2 %	54.3 %	37.0 %
10. I enjoy writing about science.	11.9 %	43.1 %	24.3 %	17.0 %	55.0 %	41.3 %
11. I like learning science in school.	26.8 %	45.7 %	13.4 %	7.2 %	72.5 %	20.6 %

SCIENCE RESEARCH QUESTIONS-SOCIAL	Strongly agree	Agree	Disagree	Strongly disagree	Generally like (1 + 2)	Generally dislike (3 + 4)
12. Science benefits our society.	32.8 %	49.8 %	5.8 %	2.2 %	82.6 %	8.0 %
13. For the most part, science will eventually solve most problems such as pollution and disease.	25.0 %	57.5 %	9.1 %	2.7 %	82.5 %	11.8 %
14. Science will help bring world peace.	8.2 %	38.1 %	36.1 %	9.5 %	46.3 %	45.6 %
15. The methods of science are fine for scientists, but there is little in these methods to help people with everyday problems.	10.0 %	42.8 %	29.7 %	10.8 %	52.8 %	40.5 %
16. Studying science is more important for boys than for girls.	3.2 %	10.8 %	39.3 %	33.4 %	14.0 %	72.7 %
17. Boys understand science better than girls.	5.9 %	16.7 %	42.0 %	24.8 %	22.6 %	66.8 %
18. Girls get better grades in science than boys.	4.6 %	20.3 %	55.4 %	15.4 %	24.9 %	70.8 %

	Most	Some	Few	None
19. How many of our problems, such as pollution and disease, do you feel that science has caused?	19.4 %	40.0 %	29.8 %	7.1 %

SCIENCE RESEARCH QUESTIONS-SCHOOL	Much	Some	None
How much have you studied each of these areas in the seventh or eight grade?			
20. Life science topics:			
Cells	35.9 %	47.1 %	5.1 %
Plants	22.9 %	54.1 %	10.9 %
Protists (bacteria, algae, fungi)	24.3 %	46.8 %	16.4 %
Animals	27.1 %	45.6 %	14.7 %
Human beings	38.4 %	36.2 %	12.5 %
Ecosystems (ecology, environment)	17.3 %	43.2 %	24.9 %
Genetics (heredity)	15.4 %	37.4 %	34.6 %
Evolution (development of species)	15.3 %	43.5 %	28.8 %
21. Earth science topics:			
Astronomy (stars)	17.8 %	47.1 %	27.8 %
Geology and natural resources (rocks)	25.6 %	47.7 %	19.7 %
Meteorology (weather)	19.3 %	46.6 %	25.8 %
Oceanography (ocean)	17.5 %	41.6 %	32.8 %
22. Physical science topics:			
Physical states and changes of matter (solids, liquids, gases)	38.7 %	51.1 %	5.8 %
Chemical and nuclear reactions of matter (elements, compounds, fission, fusion)	26.9 %	47.7 %	20.8 %
Mechanics (simple machines)	16.5 %	36.5 %	41.7 %
Energy sources and changes	30.0 %	52.0 %	12.5 %
Heat	34.1 %	49.1 %	11.2 %
Light	34.0 %	46.7 %	13.7 %
Electricity and magnetism	24.0 %	46.3 %	24.4 %
Sound	20.2 %	42.0 %	32.7 %

Results of Science Research Questions Included on the Survey of Academic Skills: Grade 8, 1985-86 (continued)

23. Which of the following instruments and materials have you used in science class?

	Yes	No
Anemometers	7.9 %	92.1 %
Aprons	15.4 %	84.6 %
Aquariums	20.8 %	79.2 %
Balances	53.1 %	46.9 %
Barometers	26.8 %	73.5 %
Beakers	59.5 %	40.5 %
Bunsen burners	50.2 %	49.8 %
Chemicals	61.0 %	39.0 %
Computers	17.1 %	82.9 %
Diffraction gratings	5.7 %	94.3 %
Filters	29.6 %	70.4 %
Fossil specimens	29.4 %	70.6 %
Fruit flies	3.5 %	96.5 %
Funnels	50.9 %	49.1 %
Inclined planes	17.3 %	82.7 %
Kites	2.8 %	97.2 %
Lenses	51.1 %	48.9 %
Magnets	44.7 %	55.3 %
Metric rulers	62.1 %	37.9 %
Microscopes	70.5 %	29.5 %
Mirrors	29.2 %	70.8 %
Petri dishes	23.5 %	76.5 %
Plants	36.3 %	63.7 %
Power supplies	36.4 %	63.6 %
Preserved specimens	35.9 %	64.1 %
Prisms	23.7 %	76.3 %
Ring stands	27.1 %	72.9 %
Rock and mineral samples	51.0 %	49.0 %
Rockets	9.0 %	91.0 %
Safety goggles	36.4 %	63.6 %
Sling psychrometers	4.4 %	95.6 %
Streak plates	12.6 %	87.4 %
Telescopes	37.3 %	62.7 %
Thermometers	49.5 %	50.5 %
Tuning forks	16.5 %	83.5 %
Voltmeters	12.5 %	87.5 %

	Two or more	About one	Less than one	Almost none	Never
24. How many hours do you spend a week doing experiments in your science classes?	19.2 %	19.8 %	18.3%	21.7 %	13.1%

	Every day	Two or three times	About once	Never
25. How often, each week, do you use a science textbook in your science class?	30.2 %	32.7 %	12.6 %	14.3 %

	Three or more	Two	One	None
26. How many science field trips did your science class take this year?	2.0 %	4.1 %	9.9 %	75.4 %

	Once per week	Once per two weeks	Once per month	Never
27. How often does your teacher share or discuss scientific newspaper articles, magazine articles, or TV programs with your class?	42.2 %	17.0 %	16.7 %	20.2 %

28. To do experiments in our science classrooms, we have:

a) lots of good science equipment.	46.2 %
b) some things we need.	36.8 %
c) almost nothing that we need.	5.9 %
d) no equipment at all.	4.0 %